CHAPTER 3 CASE STUDY

CAPTER 3. CASE STUDY

1. Objective

The case study is aimed at investigating the management of enterprises related to the mining industry and discussing issues on management and technical aspects in Armenia. The study will promote privatization and introduce foreign investment and environmental protection.

2. Target Selection and Investigation Method

2-1 Target Mine and Smelter

The Kajaran, Agarak and Kapan mines were the possible targets nominated by the Armenia counterpart as state owned enterprises for the case study (as of July 2003). A mining complex was selected among these three mines for the case study based on the selection criteria on the following page.

On the other hand, the Alaverdi Smelter, the only copper smelter in Armenia, was already privatized. As above described, it is necessary to point out the issues regarding the Alaverdi smelter clearly and make a clear solution of the issues. If it were impossible to make this point clear, the promotion program for copper industry in Armenia would be not examined concretely. Therefore, the Alaverdi smelter is also selected as a case study facility related to the mining industry. At the same time, possibility of copper production in Armenia is discussed and an action program is proposed.

2-2 Selection Criteria and its Result

Before the preliminary field survey, the selection items were discussed and established with the Armenian side. The items are the criteria to select a state owned mining enterprise among three mining complexes for the target of the case study. As the basic items of the national mines, management policy, business strategy, long–term plan, finance analysis, sales strategy, market, ore deposit and reserves, mining method, productivity, break-even cost, investment in plant and equipment, environment protection and investment in ecology were selected, showing in Table 3-2-1. Efforts were made to collect the statistics for the criteria items. A target mine was selected on the basis of the statistic evaluation. The Kapan Mining Complex had the lowest evaluation. Therefore, the Kapan Mine was selected as the case study mine from the following viewpoints.

1) The complex is operating in deficit. Without radical restructuring, the complex will not be privatized and the development of the mining business cannot be expected.
2) The Kapan deposit is a small to middle scale deposit. It is a typical deposit in Armenia. The mine is operated mainly by underground with comparatively old equipment and machinery, and same in the processing plant. The productivity of the entire mine is very low. Reconstruction of the mine must be considered by some rationalization.
3) Prospective area for gold, silver and copper seems to exist around the polymetallic deposit in the Kapan Mine. The future more exploration may attain a long-term stable supply of nonferrous metal material to the Armenian mining industry.

Table 3-2-1 Results of Selection Criteria for the Case Studies

Criteria	Kajaran		Agarak		Kapan	
Management policy	○	Selective mining	△	JV w/ Zangezur	△	Increasing polymetaliic ore
Business strategy	○	Mo trioxide	△	Using waste dump	△	Increasing Shahumian ore
		Rhenium plant				50 % of achievement
Medium- and long-term planning	×	None	×	None	×	None
Financial analysis	○	Surplus	×	Deficit	×	Deficit
Sales strategy	○	Mo: stable	×		×	
Market	○	Europe, domestic	○	Zangezur combinat	○	Iran
Deposit	○	Porphyry Mo-Cu	○	Porphyry Mo-Cu	△	Vein, zoned network
Reserves	○	Cu: 4 mln t	○	Cu: 0.2 mln t	△	Cu: 0.2 mln t
		Mo: 0.6 mln t		Mo: 0.02 mln t		Au: 40 t
Potentiality	×	Almost explored	×	Almost explored	△	Around Shahumian deposit
Mining method	○	Open pit	○	Open pit	△	Mainly underground
Productivity (Cu metal/person)	△	4.7 t	△	5.1 t	×	1.3 t
Break-even cost	△	1,450$/t	×	1,600$/t	×	1,600$/t
Investment in plant & equipment	△	Mo plant	×	Shortage of dump trucks	×	
Environmental control system	×	Standard existence	×	Slime flowing out	×	Standard existence
Investment in environment	△	4-5% of sales	×		×	Using of Kajaran tailing dam
Total Point	20		11		8	
Result of Selection						☆

Point: ○: 2, △: 1, ×: 0

2-3 Investigation Method

- The present site situations were surveyed by site-visits to the Kapan Mining Complex and Alaverdi Smelter, and the information on their operation was collected by hearing from related people at the sites as well as at Yerevan. Site visits were done October to November 2002.
- Various analyses and economic evaluation were carried out based on attained information and data.

3. Kapan Mining Complex

3-1 Introduction

The Kapan Mining Complex is located around the border of Azerbaijan by the Voghchi River and some 320 km by road from the capital, Yerevan. The Kapan ore deposit was discovered at the beginning of the nineteenth century, and the Kapan Mining Complex has continued operating for about 150 years. The mine complex is located at the lower end of the city on the north side of the river. There are two deposits under operation. They are the Central copper deposit and the

Shahumian polymetallic deposit containing copper, zinc, lead, gold and silver. The Central Mine lies some 7 km to the NNW of the plant, and Shahumian Mine is immediately adjacent to the complex to the north (Appendix 3-1).

The Central Mine is operated by both methods of underground and open pit, and the Shahumian Mine by underground. The Kapan Mining Complex has a maximum yearly capacity of one million tons of copper crude ore treatment and 300 thousand tons of polymetallic crude ore treatment. The Mine produces pure copper concentrate, and copper and zinc concentrate containing gold and silver. All concentrate is exported to Iran through an agency of the Ural International Incorporated of Switzerland and sold FOB at the border. The Kapan Complex has been forced to continue a deficit for the past 6 years owing to a decreased copper price and other reasons. Its production is less than half of the budgeted amount due to a shortage of working capital. There are 798 personnel at the complex as of the end of 2001. An organization chart of the Kapan Mining Complex is shown in Appendix 3-2.

3-2 Geology and Mineralogy

The Kapan deposits are of vein type and stockwork type deposits hosted in Middle Jurassic volcanic rocks and minor sedimentary rocks. Ore bodies are overlain by a gypsum-rich stratabound horizon and the reason that the horizon is reported to contain breccia-like rounded fragments of sulphide mineralization, there is information which considers the Kapan deposits as Kuroko-type deposits. Nevertheless no significant associated stratiform massive sulphide has yet been discovered. In the Kapan Area two mines exist. They are the Central Mine with siliceous copper veins and stockworks, and the Shahumian Mine with polymetallic copper-lead-zinc-gold-silver veins.

The Central Mine deposits, which comprise steeply dipping copper veins and their associated overlying stockworks, are found in a suite of basalts, andesites and dacites. The ore is composed mainly of chalcopyrite, pyrite and quartz. The Baskensky Fault divided the Central Mine into two parts of eastern and western. In the eastern part the Kavart deposit of stockworks is now under operation between 940m and 930m levels by open pit mining and this deposit continues to the 810m level. In the western, the Northern Stockwork deposit of stockwork type and the Katar deposit of vein type are present and the former is working by underground mining, the latter is already mined out. They say that a new deposit of the Kadzor (5 million tons, 2.0% Cu), just adjacent to west of the Northern Stockwork deposit, is now under development by open pit mining. Resources of 2.3 million tons with 1.0% Cu for underground and 0.7 million tons with 0.5% Cu for open pit are estimated.

The Shahumian deposit comprises more than 100 steeply dipping copper-zinc-gold veins hosted by andesites and dacites of Middle Jurassic. 66 veins among them are calculated. Middle Jurassic is unconformably overlain by a series of Upper Jurassic tuffs, conglomerates, breccias, porphyrites and limestones. The Shahumian veins strike approximately E-W, dip at 75-90 degrees to the south, and have a 1.75 m in average width. They have an average down-dip and strike length in the 250 - 400m range. Mineralization in the Shahumian is limited by Bavobatum-Haladsky fault in

the western and by Haladzsky fault in the northeastern parts. The ore is composed mainly of chalcopyrite, sphalerite and minor galena. There is no significant oxidation reported, even in the sub-outcropping veins. Gold values are highest in the uppermost part of the veins. In 1989 combined C1 reserve of 12.3 million tons with 0.56% Cu, 2.49% Zn, 0.17% Pb, 2.5g/t Au and 49.82g/t Ag was reported and now the reserve increases to 14 million tons with 0.57% Cu and 3.0% Zn, including 4 million tons of over drainage level of 780mL.

Middle Jurassic horizon between the Central Mine and the Shahumian Mine is considered as a potential area, vein type and/or stockwork type mineralization are expected. In the northern side of the Central Shaft and lower part of the 700M level at the Shahumian Mine, insufficient exploration was carried out and detailed explorations are needed to clear ore reserves and grades.

3-3 Mining Operation

(1) Mining Situation

1) Production

Production from each mine in the Kapan Mining Complex for the past 6 years is shown in Table 3-3-1. Production from the Central Underground decreased from 1996 to 2000 because the Mine put emphasis on production preparation on the Shahumian Mine and open pit in 2000 as well as the insufficient mining machines and explosive materials from a lack of working capital. Production was recovered somehow in 2001 by an advanced payment from their concentrate buyer. The decrease of gold and silver grades in the crude ore from the Shahumian Mine was due to composition of the mining blocks.

Table 3-3-1 Production Results

Mine	Item	Uunit	1996	1997	1998	1999	2000	2001
Central	Production		297,801	177,325	189,269	114,810	26,592	52,901
Underground	Ore grade	Cu %	0.86	0.79	0.74	0.69	0.82	0.8
Central	Production	t	0	0	0	0	57,320	128,109
Open Pit	Ore grade	Cu %	0	0	0	0	0.47	0.44
Central	Production	t	297,801	177,325	189,269	114,810	83,912	181,010
Total	Ore grade	Cu %	0.86	0.79	0.74	0.69	0.58	0.55
Shahumian	Production	t	37,765	48,421	44,074	71,747	52,689	87,534
	Cu grade	Cu %	0.33	0.32	0.37	0.32	0.35	0.3
	Zn grade	Zn %	1.9	1.76	2.73	2.01	1.42	1.14
	Pb grade	Pb %	0.12	0.13	0.16	0.2	0.31	0.21
	Au grade	Au g/t	3.08	2.6	2.9	1.95	1.74	1.34
	Ag grade	Ag g/t	35.22	38.26	49.55	27.25	28.35	21.82
Kapan	Production	t	335,566	225,746	233,343	186,557	136,601	268,544
Total	Ore grade	Cu %	0.8	0.69	0.67	0.55	0.49	0.47

2) Ore Grade

Samples are collected from each mine car before passing to the crushing process. Comparison between the calculation of the ore reserve and result of analyzed samples is shown in Table 3-3-2. This table shows the copper grade of the sampled ore is about 25% less than the ore reserve, and other metals from the Shahumian Mine decrease much less than the ore reserve.

Table 3-3-2 Comparison of Ore Grade (As of 2001)

Item	Ore Reserve				Sampled Ore			
Metal	Cu	Zn	Au	Ag	Cu	Zn	Au	Ag
Unit	%	%	g/t	G/t	%	%	G/t	g/t
Central U/G	1.00	—	—	—	0.75	—	—	—
Central O/P	0.60	—	—	—	0.41	—	—	—
Shahumian	0.37	2.19	3.36	66.68	0.28	1.07	1.25	20.45

N.B. U/G: underground, O/P: open pit

valuable gold and silver especially decreased down to less than 30%. This difference indicates poor dilution control in the mining operation in comparison to the estimated dilution in the ore reserve calculation. It may give a serious impact to profitability.

3) Mining Method

There are two principal underground mining methods adopted at both the Central and Shahumian Mines: shrinkage and sublevel stoping. Each method is varied as required to suit the dip, orebody thickness and local rock strengths. Shrinkage is adopted where the orebody is up to 3 m thick and sublevel stoping where it is thicker than 3 m. Present production ratio of shrinkage and sublevel stoping is 20%: 80%. Current mining blocks are in Table 3-3-3.

Table 3-3-3 Number of Mining Blocks in Underground

Mine	Sublevel stoping		Shrinkage		Total
	No. of mining blocks	No. of preparing blocks	No. of mining blocks	No. of preparing blocks	
Central	3	1	2	1	7
Shahumian	4	1	3	2	10
Total	7	2	5	3	17

More sublevel stoping in the current production depends on the characteristics of the mining method because the broken ore must be kept as operation scaffold and only 30% ore is drawn in the daily operation for shrinkage. All broken ore in shrinkage is drawn after all mining is finished so the final production ratio should be approached for the long-term. By the production plan, there are 24 mining blocks being prepared at the Central and Shahumian Mines. But in reality there are only 5 blocks at both mines, less than 20.8%. The reason for the lack of development is a shortage of funds. In the near future, it may be very hard to keep the current production level as the number of mining blocks decreases, so it is very urgent to prepare the next mining blocks. Minable ore and dilution percentage are shown in Table 3-3-4. For the minable percentage, there is no difference between two mining methods because both methods are basically the same for scheduled mining block. There is no data of dilution on sublevel stoping, but it may be larger than that for shrinkage because sublevel stoping cannot control overstoping of the hanging and footwalls.

Table 3-3-4 Minable and Dilution Percentage

Mine	Mining method	Minable	Dilution
Unit		%	%
Central	Shrinkage	94.1	19.5
	Sublevel Stoping	93.7	—
	Open Pit	96.9	—
Shahumian	Shrinkage	93.3	18.5
	Sublevel Stoping	93.0	—

4) Development

Development drifting is carried out by a combination of jackhammers, air legs and rocker

shovels. The general standard of development is reasonable. The tunnel profile and maintenance are comparatively common. Table 3-3-5 shows the result of development for the past 6 years.

Table 3-3-5 Results of Development

Mine	Unit	1996	1997	1998	1999	2000	2001
Central	M	1,092	414	122	395	44	90
Shahumian	M	382	119	201	245	312	276
Total	M	1,474	533	323	640	356	366

This table describes the drastic decrease of development. In 1996 when the deficit began, development didn't decrease so drastically yet, but the next year development dropped down to one-third. The following years' development was dropped to one-fourth so there was a serious shortage of preparation for mining blocks.

5) Mining Machinery

Main machine manufacturers are Russian except Japanese Komatsu (Appendix 3-3). From the viewpoint of spare parts control and its prices, Russian made machines are desirable. Machines for underground are driven by compressed air and machines for open pit are driven by diesel engine.

The problem is the number of machines; especially jackhammers are a few so it is strongly related to the shortage of development for mining blocks. The problems occurred by the shortage of the funds due to the deficit management.

6) Explosives

Explosives used in the Mines are all home made. The Mine uses Gamonite in place of dynamite and ANFO. The former is packed in a cylindrical wrap of 32 mm ϕ $\times$200 mm and the latter in 90 mm ϕ $\times$300 mm.

The operations of the Central Mine (underground mine and open pit) and the Shahumian Mine are explained in Appendix 3-4.

(2) Recommendations for Mining Operation

As for profitability at the Kapan Mining Complex, the current largest contributor is the Shahumian Mine with polymetallic type copper ore containing gold and silver. It will be quantitatively proved later in an economic evaluation. On the other hand, the largest contributor in production is the Open Pit. But there are too many departments without direct relation to production. The organization should be simplified with additional departments absorbed into the Engineering Department. On the contrary, the detailed organization of the Open Pit is not clear. The workers under the foremen should be defined more clearly. Haulage transportation and dump trucks belong to other departments, but should belong to the Central Mine to increase working efficiency in a more direct manner.

Decreasing dilution is a serious and important theme. A detailed indication seems to be needed for the Open Pit to control dilution. There are some limitations from the mining method in case of underground dilution. It is impossible to eliminate waste inside of the deposit in the adopted methods, sublevel and shrinkage stoping, but it is possible to control waste in the hanging wall or footwall by detailed instruction at the site. Under this circumstance, a quality control department is recommended to be prepared in the organization to decrease dilution effectively.

The engineer at the Kapan Mining Complex says the Kadzor Mine with a grade of 2%

copper was discovered north of the Kavart vein, which is now being exploited by open pit. Some preparations for production like track road and ore pass raise were finished. The production from the Kadzor Mine with a much higher ore grade should be taken into consideration after economic evaluation.

In the underground mine, the delay of the development for preparation of mining blocks is serious owing to a lack of machines and spare parts caused by a shortage of funds. Production from the underground might be insufficient in the near future. At first, economic profitability must be understood, and new mining blocks should be prepared urgently by the provision of funds, if profitable. A delay of the development especially in the Shahumian Mine will give a very serious impact to maintain the total operation of the Kapan Mining Complex. Therefore some countermeasures should be taken as soon as possible.

In the long-term view, introduction of a new mining system like "cut and fill" and "highly mechanized trackless" should be studied to obtain a much higher efficiency, considering the improvement of dilution control as well as future increase of workers' wage.

3-4 Processing Operation

(1) Present Situation of Processing

An organization for the Processing Plant is shown in Appendix 3-5. The Processing Plant has four shifts and operates 7 days a week according to its budget, but in reality about 4 days a week due to lack of funds and mined ore. The processing operation is described as follows.

1) Treated Mineral

The copper ore occurs in two types: as a vein in stockwork and disseminated mineralization. The ore minerals of stockwork ore are mainly chalcopyrite and pyrite while disseminated ores contain pyrite, chalcocite, bornite, enargite, chalcopyrite, covellite and tennantite. Gangue minerals include quartz, calcite, gypsum and kaolin.

The polymetallic deposit has a slightly more complex mineralogical assemblage. The main ore minerals are chalcopyrite, galena, sphalerite and bornite. Gangue minerals include quartz, carbonates and pyrite. Very significant quantities of gold and silver occur associated with tellurides.

2) Processing Result

Copper processing results during the past 6 years are shown in Appendix 3-6. The reasons for dropped recovery in 2000 are the decrease in crude ore grade because of starting the Open Pit ore treatment, much clay contained in the Open Pit ore and a shortage of reagent caused by a lack of funds. Increase of moisture in concentrate is by a shortage of some spare parts of filters.

Polymetallic processing results are in Appendix 3-7. Comparing the results with Japanese data for "Kuroko" type, Kapan's data are slightly worse, but generally reasonable values. Taking into account the 50% of the treated amount of the budget owing to a shortage of reagents and crude ore, it must be evaluated as a good result.

3) Analysis Results of the Concentrate

Analysis results of the concentrate produced in the mine are shown in Appendix 3-8.

These data were obtained from the concentrate buyer except for the Shahumian lead

concentrate. A laboratory in the mine is not available for the processing test. According to the result, the comparatively higher grades of zinc, lead and arsenic in the copper concentrate are noted and may have some influence on the sale contract of the concentrate.

4) Main Machinery for the Processing Plant

The main machinery used in the processing plant is shown in Appendix 3-9. All machinery is Russian made. Some machines are decrepit, but all machinery is working normally at present. The mine engineer states that there is no machine that must be repaired urgently, but some spare parts and consumables are insufficient. This situation can be understood easily by the processing results. At the current operation level that is 50% of the plan, there is sufficient time needed for repairing equipment and machinery. If the treated ore would increase, however, there are some doubts about keeping the same processing results. It seems to depend on the operational effect of the old machinery. This table includes some equipment for separation of the lead concentrate. The equipment is not assembled yet and kept at the plant.

The machinery in the plant has many varieties because there are two processing lines, one for copper processing and another for a complicated polymetallic processing. The flow sheets for two lines are shown in Appendix 3-10.

5) Reconciliation between Reserve Estimates and Processing

Table 3-3-6 shows a comparison between the ore grade estimates of the reserve calculation and calculated grade from the processing operation. Generally, the grade from the processing is lower than the reserve estimates, especially remarkable in gold and silver are half and one-third, respectively. On the other hand, there is not much difference between the sample analyzed value and calculation value from the processing. Accordingly, it indicates a larger dilution in mining than the reserve estimates.

Table 3-3-6 Comparison of Ore Grade

Kinds of grade	Grade estimated in reserve				Grade calculated by processing result			
Metal	Cu	Zn	Au	Ag	Cu	Zn	Au	Ag
Unit	%	%	g/t	G/t	%	%	g/t	g/t
Central U/G	1.0	—	—	—	0.52	—	—	—
Central O/P	0.6	—	—	—		—	—	—
Shahumian	0.37	2.19	3.36	66.68	0.28	1.20	1.46	25.18

If some urgent countermeasures for dilution could not be taken, the grade of the reserve must be multiplied by a realization coefficient listed in Table 3-3-7.

Table 3-3-7 Realization Coefficient for the Grade of Reserve

Metal	Cu	Zn	Au	Ag
Central U/G	0.72	—	—	—
Central O/P	0.72	—	—	—
Shahumian	0.76	0.55	0.43	0.38

6) Tailings Treatment

Tailings from the plant flowed by gravity and they were pumped up to the Artsvanik Tailings Dam controlled by the Kajaran Mine before 1999. But it is reported the tailings could not reach to the dam because of the increasing elevation. As a consequence, approximately 30,000 tons each of copper and polymetallic tailings have been discharged into the river since September 1999. They plan to reconstruct the old tailings dam, Geghanush, and discharge the tailings to it when

finance becomes available.

(2) Recommendation for Processing Operation

The additional departments except production in the organization of the Processing Plant are too many and complicated is just the same as Mining. It should be simplified with additional departments absorbed into the Engineering Department. An experienced engineer should be put between the superintendent of the plant and foremen to give exact operational indications when necessary, because there is no engineer in the production line. Some fields directly connected with production like recovery and quality control should be strengthened. Also, appropriate disposition of workers must be considered fully. For instance, there are unnecessary workers for sampling crude ore from the mine cars or weighing mine cars.

The current flow sheet for polymetallic ore is thought to have improved based on the past operation, but it seems to be a little more complicated than the international standard level. The process should be simplified to obtain a better production control. For reference, one example of a Japanese flow sheet for similar quality of "Kuroko" is shown in Appendix 3-11.

An important point of polymetallic processing is to recover valuable metals as much as possible for a higher profit. In reality, lead is contained in the copper concentrate, but it is a possible penalty rather than a bonus. The Mine purchased some equipment except a steam producer to increase the pulp temperature for lead separation. The lead separation process seems to be constructed easily. The Mine must also study the profitability of the recovery of sulfide iron.

The produced concentrate contains some other metals with comparatively higher grade. If these metals are penalties in the sales contract, all flow sheets should be adjusted to obtain highly pure concentrates, which are very important for the profitability of the Complex.

The present situation of tailings, which are discharged into the river, is not permitted environmentally. Tailings contain valuable metals like unrecovered gold and silver, which may be recovered economically and technically in future. In reality, the Ararat Gold Recovery Company has been making a large profit by recovering gold and silver from the old tailings.

From long-term viewpoint, the introduction of the column flotation system to improve processing result and conserve electricity as well as autogenous grinding system to decrease operation cost should be studied.

3-5 Management

(1) Present Management

1) Profit and Loss

The copper price increased up to US$3,000 per ton in 1995 and has continued decreasing since 1996. Following this trend, the Kapan Mining Complex fell into deficit in 1996 and has managed the very severe situation with total debt of US$7 million for six years. Table 3-3-8 shows the profit and loss statement.

The gold price also has continued decreasing since 1996 so it has influenced the management too. Operating cost was reduced 60% between 1996 and 2000, but production also decreased in the same proportion so an improvement in profitability was not recognized. In the same

period, the exchange rate decreased about 30% down, which might be a strong support to management of the Kapan Mining Complex.

Table 3-3-8 Profit and Loss Statement

Year	1996	1997	1998	1999	2000	2001
Exchande rate(AMD/$)	415.09	490.55	504.7	536.16	539.67	555.09
Copper price(LME $/t)	2295	2277	1654	1573	1814	1578
Gold price(London $/toz)	388	331	294	279	279	271
Sales (×1000 US$)	2,892	1,796	1,469	1,155	1,255	1,673
Central U/G mining cost	2,128	1,226	853	660	304	455
Central O/P mining cost	0	0	0	3	118	218
Shahumian mining cost	371	361	258	470	379	489
Copper processing cost	816	518	519	309	288	486
Polymetal processing cost	378	392	314	363	370	474
Processing miscellaneous cost	504	338	150	206	228	260
Indirect cost	23	20	19	215	12	5
Total cost	4,220	2,855	2,113	2,226	1,699	2,387
P/L	−1,328	−1,059	−644	−1,071	−444	−714

2) Number of Personnel

The number of mine workers is shown in Appendix 3-12 for the past 6 years under a low production level. About 1,000 men worked in 1996, but the workforce decreased 20% in 2001 by management effort. Proportion of supplementary workers to principal workers slightly improved from 1:1.8 to 1:1.7, but production decreased about 20% during the same period so the decrease of workers was still insufficient for an emergency countermeasure. In other words, supplementary workers are still too many compared to principal workers.

3) Workers' Salary

Workers' salary for 6 years at the mine by kinds of occupation is shown in Appendix 3-13. The decreased salary during these six years is noted. For example, the average salary was reduced 40% for miners who work at the central production of the mine. This fact may cause a serious decrease of workers' morale. There are some yearly deviations for workers in the same job. It is influenced by an efficiency payment system for principal workers and a bonus for achieving above a quota for other jobs. These systems are good for increasing working morale, but the system is not thought to function well by reason of the low production level owing to a lack of funds. The executives stated the average salary of the Kapan Mining Complex is about half of the Kajaran Mine. Accordingly young workers do not continue working so pensioners take over the jobs, which push up the average age of the mineworkers too much more than 50 years old.

(2) Cost Analysis

Production and unit costs for the Kapan Mining Complex were compiled and are shown in Appendix 3-14. According to the table, mining and processing unit costs of the Shahumian Mine have generally decreased, and much effort seems to have been made for it. But unit costs for the Central underground are a little worse by reason of the sharp drop in production. On the contrary, the unit cost of the Open Pit is very small, one-fifth of underground, and is the lowest.

Let us compare the production unit cost with one of the international mines. For instance, the Erdenet Mine in Mongolia prides itself on US$ 5 per ton of treated ore or US$ 880 per ton of

copper metal in 2001. The Madneuli Mine in Georgia has a production unit cost of about US$ 9 per ton of treated ore or US$ 1,250 per ton of copper metal in 2001. The production unit cost of the Erdenet Mine is about half of the Kapan Mine based on treated ore and one-third for a metal base because it produces 24 million tons yearly so the economy effect of scale is very large. On the other hand, the Madneuli Mine is a small open pit with an annual production of 1.5 million tons. Its production unit cost is almost the same as the Kapan Mine based on treated ore, but half on a metal base. The reason is a better crude ore grade. The operation unit cost of the Chilean El Teniente Mine and Los Pelambres Mine, which operate an open pit as well as underground mine just the same as the Kapan Mine is about US$ 1,700 on a metal base as of 1997. Kapan is much worse than them.

(3) Recommendations for Management

The current organization is too large for its production level, and the influence of FSU system remains. The Kapan Mining Complex must be much smaller under its large accumulated deficit. Current departments should be reduced to less than half. The Kapan Complex is a production unit so it must be changed to an organization with a minimum number of workers connected to direct production eliminating unnecessary indirect departments.

It is a serious problem to have more supplementary workers than principal workers. Many workers are needed in electric and mechanic department to repair and maintain old machinery and equipment, but there seems to be some inefficiency. To solve the situation by increasing efficiency, the maintenance department might become an independent company from the Kapan Complex. Under a contract, the Kapan gives work to it. On other hand, the deskwork should be computerized for daily quantitative control based on exact and timely data. Accordingly, the mine must eliminate higher posts above engineers demonstrating efficiency improvements.

Workers' salary is also a serious problem. It has decreased every year, and the salary cannot be paid as scheduled. Under the circumstances, workers' morale seems to have decreased considerably. In the future, the Kapan Complex must first make a profit and reduce indirect departments to increase the salary for workers in direct production departments, which are necessary to maintain the mine operation.

The Kapan Mine must compete against global mining companies because it produces international goods. But unfortunately, the current situation is very severe after cost analysis. The Kapan Mine needs to continue making an effort to reduce cost. The management stated it makes an effort for conserving electricity, which is 30% of all costs, but it is impossible to obtain an effective result without an investment for conserving electricity.

3-6 Economic Evaluations

(1) Cash Flow Analysis for Current Mining Operation

The current mining operation of the Kapan Complex consists of the Central Mine, Central Open Pit, Shahumian Mine, copper process circuit and polymetallic process circuit. The profitability of the current production system as well as the Kadzor Open Pit, which has already finished some preparation for production, is proved under the condition that the current production facility works normally. There are four combinations of production system as follows:

1) Central Mine－copper process circuit
2) Central Open Pit－copper process circuit
3) Kadzor Open Pit－copper process circuit
4) Shahumian Mine－polymetallic process circuit

1) Metal Prices

Metal prices used for the economic simulation are in Table 3-3-9.

Table 3-3-9 Metal Price used in Cash Flow (as of Aug. 2002)

Metal	Price	Note
Copper	$1,479.6/t	LME
Zinc	$747.6/t	LME
Gold	$310.3/toz	London price
Silver	$456.2/toz	USA, HH

2) Assumed Sales Condition

The sales contract of the Kapan Complex is secret. So general sales conditions are assumed as in Table 3-3-10.

Table 3-3-10 Assumptions for Concentrate Sales Condition

Mine	Conc.	Metal	Payment condition	T/C	R/C	Penalty
Central	Cu	Cu	Unit deduction 1% From concentrate	$80/t	6.5 ¢ /t	Deduct $2.5/0.1% more than 0.2% As, no penalty less than 0.1% Sb.
		Au	N/A	―	―	
		Ag	N/A	―	―	
Shahumian	Cu	Cu	Unit deduction 1% From concentrate	$80/t	6.5 ¢ /t	Deduct $2.5/0.1% more than 0.2% As, no penalty less than 0.1% Sb and 20g/t Hg.
		Au	Unit deduction 1g/t 90% evaluation	―	$6.0/toz	
		Ag	Unit deduction 30g/t 90% evaluation	―	$0.4/toz	
	Zn	Zn	85% of concentrate	$175/t	None	No penalty less than 0.3%As, 0.3% Sb, 50g/t Hg and 3%SiO_2.
		Au	Unit deduction 2g/t 60% evaluation	―	$6.0/toz	
		Ag	Unit deduction 50g/t 60% evaluation	―	$0.4/toz	

In case there is high-grade lead or zinc in the copper concentrate, some penalties are imposed in advanced countries, but these penalties are neglected in this calculation. Analysis results of the concentrate are listed in Appendix 3-8.

3) Concentrate Moisture

Concentrate moisture has increased recently due to a lack of spare parts for filters. But the plant engineer stated it could be repaired so normal moisture of 11% for the Central copper concentrate, 10% for the Shahumian copper concentrate and 8.6% for the Shahumian zinc concentrate, the same as 1996 results, are adopted for the calculation.

4) Transportation Cost of the Concentrate

The Kapan Complex has a FOB contract to sell the concentrate to the buyer at the border of Iran. The distance between the border and Kapan plant is about 80 km so its freight is US$12/t according to a transporter. The total freight is estimated US$30/t including a transit charge cost of US$300 per truck with a capacity of 20 t and miscellaneous costs like a road tax.

(2) Summary of Cash Flow Analyses

Results of cash flow analyses for all cases (see Appendix 3-15) are summarized in Table 3-3-11 with a production of 100,000 t by the current operation system. The Central Mine underground and open pit operations are unprofitable and must be stopped.

Table 3-3-11 Summary of Cash Flow Analyses (US$)

Item	Central U/G	Central O/P	Kadzor O/P	Shahumian Mine
Sales	596,000	249,000	814,000	1,438,000
Expense	1,082,000	537,000	537,000	1,229,000
P/L	-486,000	-289,000	276,000	210,000

The most profitable case is the Kadzor Open Pit, which is worth watching with keen interest. The key to success for solving the present difficulty of the Kapan Mining Complex is in the Kadzor deposit. Preparation and increase of production by open pit are much easier than ones by underground. Machines and its production system can be settled quickly by shifting machines and workers from the current Central Open Pit.

The Shahumian Mine is presently the only profitable mine of the Kapan Complex. Consequently shifting machines and workers from the Central Underground should strengthen the production system of the Shahumian Mine.

Dilution control is also ascertained to be very important in daily production. The profit of the Shahumian Mine will be improved very much by adequate protection against dilution because it contains gold and silver of very high prices.

(3) 10-Year Production Plan including Some Rationalization

A new production plan is devised for the Kapan Complex to survive, taking into account the simulation results. Mainframe in the plan is as follows.

1) The Central underground and open pit stops their all operations.
2) The workers and machines in the Central underground are moved to the Shahumian Mine. New mining machines are purchased to prepare stopes and increase production up to 150,000 t in four years and finally 300,000 t, its capacity, eight years later.
3) The workers and machines in the Central open pit are moved to the Kadzor Open Pit. New machines are increased to produce 200,000 t in three years and 500,000 t, half of its capacity, five years later.
4) The crude ore grades of both the Shahumian Mine and Kadzor Open Pit are improved by strengthening dilution control.
5) The organization of the Kapan Complex and allocation of workers are changed to be more effective and functional. For that purpose, administrative persons and supplementary workers are reduced.
6) Office works are computerized to obtain immediate and exact data and advance management quantitative control and administrative persons use computers.
7) The lead concentrate separation process from the copper concentrate should be finished, but each concentrate grade and recovery were not presented so this new process is outside of the consideration in this production plan.

The 10-year production plan for the Kadzor Open Pit and Shahumian Mine is in Table 3-3-12 and 3-3-13 respectively. Values in these tables are adopted on the assumption that some improvements in the operation are accomplished like better dilution control in mining and improving recovery and concentrate grade in processing. However, these are not only a goal for operation, but also achievable object that was experienced in the past.

Table 3-3-12 Production Plan of the Kadzor Open Pit

Item	Unit	Year									
		1	2	3	4	5	6	7	8	9	10
Treated ore	1000 t	50	100	200	350	500	500	500	500	500	500
Cu grade in ore	Cu %	1.44	1.48	1.52	1.56	1.60	1.60	1.60	1.60	1.60	1.60
Cu recovery	%	81.0	81.5	82.0	82.5	83.0	83.0	83.0	83.0	83.0	83.0
Cu grade in conc.	Cu %	23	23	23	23	25	25	25	25	25	25
Conc. production	1000 t	2.54	5.24	10.84	19.59	26.56	26.56	26.56	26.56	26.56	26.56
As grade in conc.	As %	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Moisture	%	12	11	10	10	10	10	10	10	10	10

Table 3-3-13 Production Plan of the Shahumian Mine

Unit	Year									
	1	2	3	4	5	6	7	8	9	10
1000 t	90	115	130	150	180	220	260	300	300	300
Cu %	0.30	0.31	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
Zn %	1.30	1.40	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Au g/t	1.60	1.70	1.80	1.90	2.00	2.00	2.00	2.00	2.00	2.00
Ag g/t	27	28	30	32	33	33	33	33	33	33
%	70	71	72	73	73	73	73	73	73	73
Cu %	15.0	15.5	16.0	16.5	16.5	16.5	16.5	16.5	16.5	16.5
%	55	55	55	55	55	55	55	55	55	55
%	65	65	65	65	65	65	65	65	65	65
1000 t	1.26	1.63	1.87	2.12	2.55	3.12	3.68	4.25	4.25	4.25
%	15	14	13	12	11	10	10	10	10	10
As %	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
%	70	71	72	73	73	73	73	73	73	73
Zn %	55.0	55.5	56.0	56.0	56.0	56.0	56.0	56.0	56.0	56.0
%	18.5	19.0	19.5	20.0	20.0	20.0	20.0	20.0	20.0	20.0
%	19.0	19.5	20.0	20.5	21.0	21.0	21.0	21.0	21.0	21.0
1000 t	1.49	2.06	2.51	2.93	3.52	4.30	5.08	5.87	5.87	5.87
%	13	12	11	10	9	9	9	9	9	9
Cd g/t	4100	4100	4100	4100	4100	4100	4100	4100	4100	4100

Table 3-3-14 shows the investments that can secure increasing production. These investments are done with a continuous operation. The investments in the first year were proposed as urgent necessities by the Kapan Complex, and others were proposed regarding a stable operation for the long term. Unit operating and indirect costs are settled in Table 3-3-15.

Table 3-3-14 Investments for Increasing Production

Item	Investment(US$1000)				
	1st year	2nd year	3th year	5th year	8th year
Mining machines	200	200	200	300	300
Ore transporting machines	200	0	0	200	200
Mining machines for the Kadzor Mine	200	200	200	500	500
Processing machines	0	200	500	500	500
Construction of the tailings dam	500	0	0	200	200
Zinc sulphate producer	100	0	0	0	0
Total Investment	1,200	600	900	1,700	1,700

Table 3-3-15 Operation Cost Assumptions for the Production Plan

Item	Cost($/t)			
	1st year	3th year	5th year	7th year
Unit mining cost for the Kadzor Mine	2.55	2.21	2.04	1.87
Unit mining cost for the Shahumian Mine	10.5	8.40	7.35	6.30
Unit copper processing cost	2.68	2.41	2.14	2.01
Unit polymetal processing cost	5.70	5.13	4.56	4.28
Unit miscellaneous costs in processing	0.98	0.88	0.78	0.74
Indirect cost	5,320	4,256	3,724	2,660

The unit mining cost for the first year of the Kadzor Open Pit is assumed to be 50% more than the Central Open Pit in 2001, taking into account of some initial stripping waste. Considering increasing efficiency and production, the unit mining cost of the Kadzor Mine is estimated to decrease gradually by 13.3%, 20% and 26.7% respectively from the first year cost in the following years. The unit mining cost for the first year of the Shahumian Mine is increased largely compared with the current cost because workers and machines of the Central Mine are moved so the first year cost of the plan is the sum of both mines' costs. But it is estimated to decrease gradually 20%, 30% and 40% from the first year cost by same reason as the Kadzor Mine. On the other hand, the unit processing cost of the first year is assumed to be same as the current cost. After the second year, it is estimated to decrease 10%, 20% and 25% respectively from the first year cost, considering the economy of scale, renovation of equipment and producing their own zinc sulphate. The indirect cost is assumed to decrease 20%, 30% and 50% respectively from the first year cost, considering downsizing of the organization.

(4) Long-term Forecast of Metal Prices

A long-term forecast of the prices is done for the metals related to the Kapan Mining Complex. Generally the metal price is determined by global balance of supply and demand. It is very difficult and almost impossible to anticipate the global economy movements for the next 10 years, but it was attempted. The past 10 year-deviations of metals' prices for non-ferrous, gold and silver are shown in Appendix 3-16.

Long-term metal prices are given in Table 3-3-16 forecasted by the above data and existing information;

Table 3-3-16 Forecast of Metal Prices

Metal	Price	Note
Copper	$1,750/t	LME
Zinc	$900/t	LME
Gold	$300/toz	London Free Market
Silver	$5.00/toz	USA H&H

(5) Economic Evaluation on the Production Rationalization Plan

The economic evaluation on the 10-year production plan is carried out based on the forecasted metal prices as above mentioned. Sales condition of the concentrate is assumed to be same as the first simulation. Results of the economic evaluation are in Table 3-3-17. Details are shown in Appendix 3-17.

The table shows that it is profitable enough to give a 28% IRR for ten years with the first year's repayment of the current debt of US$ 7 million and accumulated investment of US$ 6.2 million to increase production. The first and second years give deficits, but they are smaller than the working capital so they do not seem to be a difficult matter.

As the input data for the evaluation is very reasonable as mentioned before, the values of the simulation can be some guidelines for the management of the Kapan Complex and strong interests for international investors, which are the targets for privatization of the Kapan Complex in the national policy.

Table 3-3-17 Economic Evaluation for the Long-term Rationalized Plan

Item	Unit	1st. Year	2nd. Year	3rd. Year	4th. Year	5th. Year	6th. Year	7th. Year	8th. Year	9th. Year	10th. Year
Kadzor											
Ore treated	000't	50	100	200	350	500	500	500	500	500	500
Cu grade	Cu %	1.44	1.48	1.52	1.56	1.6	1.6	1.6	1.6	1.6	1.6
Shahumian											
Ore treated	000't	90	115	130	150	180	220	260	300	300	300
Cu grade	Cu %	0.3	0.31	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
Au grade	Au g/t	1.6	1.7	1.8	1.9	2.0	2.0	2.0	2.0	2.0	2.0
Revenue	$000	2,028	3,176	4,858	7,331	10,458	11,281	12,103	12,924	12,924	12,924
Cost	$000	2,362	3,342	3,353	5,204	5,445	5,783	5,236	6,161	5,709	1,362
Net P/L	$000	−334	−166	1,505	2,127	5,013	5,498	6,867	6,763	7,215	11,562
Investment	$000	*8,200	600	900	0	1,700	0	0	1,700	0	0

N.B. P/L : Profit and Loss, * includes debt of $ 7 million

3-7 Conclusions and Recommendations

After several simulations, the Shahumian Mine was analyzed to be the only profitable mining unit. The Central Mine, underground and open pit was found to be unprofitable at the current copper price so their operation must be stopped immediately.

Although the Shahumian Mine is profitable, the preparation of new stopes is delayed considerably and may cause a decrease of its production if it does not take some countermeasures. Workers and machines in the Central Mine should be shifted to the Shahumian Mine to prepare new stopes as soon as possible. Another problem in the Shahumian Mine is the poor control of dilution so the crude ore grade has continued to decrease. The mine profitability does not depend on the total quantity of mined ore, but the ore quality above a minimum grade. The mine should pay attention to over-stoping by means of detailed instruction at the site. There is some worry on the emphasis placed on quantity over quality in the quota system so over-stoping must be prevented.

The Kadzor Open Pit located northwest of the current pit is very profitable. A detailed geological survey must be done as soon as possible to grasp the minable ore reserve, minable ore grade, deposit conditions and the thickness and quantity of its overburden for making a production plan. When the deposit is excavated, all workers and machines used in the Central Open Pit can be shifted to the Kadzor Open Pit so the necessary preparation period for production may be shortened. An ore-pass for the Kadzor deposit was already completed so it can begin mining after preparation. Dilution prevention in this case must be carried out more severely with the suitable selection of blasting and treating of the ore and waste. The standard bench height should be strictly kept.

The very complicated current process may be very hard for enough control of its operation. A simplified process should be studied to improve the processing result by increasing the sampling frequency. Some metals contained in each concentrate are noted. If they are objects of penalties in the sales contract, the flow sheet including grinding must be reexamined after various processing tests to produce a cleaner concentrate with higher economic value.

Present machines used in mining and processing are generally old and may decrease production

efficiency so they must be renovated according to necessity.

At present, the Kapan Complex has a debt of US$ 7 million, which was from the concentrate buyers. Accordingly, the sales contract of the concentrate seems to be more severe than standard conditions. It is recommended that the Complex might negotiate with foreign investors about sales of mine on the economic evaluation of this case study. But, the economic evaluation of the report does not include the lower part of the Shahumian Mine, which is the base of the Kapan Complex. The lower part of the Shahumian Mine has a reserve of 10 million tons. If it is profitable, all international investors will be interested in the Kapan Complex. In this case, the gold and silver grade of the crude ore and operation cost for developing drifts and continuous pumping cost of groundwater might be significant economic key points.

4. Copper Smelter

4-1 Alaverdi Smelter

In this Case Study, the influence of LME price fluctuations to the management ACP with the full capacity production of Alaverdi Smelter is simulated as follows.

(1) Full Capacity Production

The yearly production capacity of the Alaverdi Smelter is 20,000 tons of blister production, 10,000 t from copper concentrate and 10,000 t from scrap. The production result of Alaverdi in 2001 was 7,056 tons. In 2001, the Kajaran Mine produced copper concentrate equivalent to 11,430 t copper, which was a sufficient supply to meet Alaverdi's production capacity. The simulation study using the blister production of 20,000 t/y, and present production capacity under the current metal price is shown in Table 3-4-1. The loss per ton is improved from the current US$ 3.14 to US$ 1 under full capacity production.

Table 3-4-1 Simulation Results of Profit and Loss of ACP

2001 result **Summary**
Blister A+B 7056 ton

	ADM x 1000	USD x 1000
Sales revenue	5,279,809	9,263
Material cost	3,814,866	6,693
Operating cost	758,092	1,330
Factory benefit	706,852	1,240
Over head	1,314,037	2,305
Transportation cost	657,310	1,153
Benefit	▲ 1,264,495	▲ 2,218

Unit loss US$ 314 /t

2001 result base Full operation **Summary**
Blister A+B 20000 ton

	ADM x 1000	USD x 1000
Sales revenue	14,921,693	26,178
Material cost	10,970,661	19,247
Operating cost	798,793	1,401
Factory benefit	3,152,239	5,530
Over head	1,314,037	2,305
Transportation cost	1,844,539	3,236
Benefit	▲ 6,337	▲ 11

Unit loss US$ 1/t

(2) P/L Changes Caused by LME Price

The influence of the LME price fluctuation on P/L of ACP was reviewed. Blister A has too many and complicated factors like gold and silver contents to be evaluated, so only copper is evaluated here for simplification. The LME price fluctuates in wide range and P/L of the smelter is greatly influenced by this fluctuation. Fluctuation of LME price is shown in Appendix 3-18, which indicates US$1,600/t to US$3,000/t in recent years. The case study is based on US$1,600/t, 2,100/t and 2,600/t.

The conditions for case study are as follows;

1) Full capacity production of blister in the same production system as the current

conditions

2) Production of electrolytic copper from blister

In this case, two further cases of sales are assumed as follows depending on the purchaser.

2)-1 Export of electrolytic copper

2)-2 Domestic sale of electrolytic copper

The premises for simulation are as follows:

a. The material and product prices : CIF
b. Au and Ag in the concentrate : not evaluated
c. Copper recovery : 98%
d. Copper content is concentrate : 28%
e. Unit material consumption for the refinery : by experience
f. Purchase price of scrap : LME－3 x (TC + RC)

The actual business will be different from the result of the case study because it is based on the abovementioned premises. Each case is explained as follows.

1) Case for Production of Blister Copper

Product is blister copper, which is the same as current product. Its yearly production is 20,000 t, i.e., 10,000 t from concentrate and 10,000 t from scrap.

2) Case for Producing Electrolytic Copper

Blister copper is produced under the same condition as the above Case 1) and electrolytic copper is produced from this blister copper. In this case, RC can be obtained. Equipment and facility cost for production of electrolytic copper is approximately US$20 million if the present buildings and other facilities are used. The current dust removal facility of the existing smelter has very low efficiency, and hazardous metals such as lead and arsenic in the concentrate that are easily evaporated are discharged to atmosphere. A high efficiency bag filter or electrostatic precipitator needs to be installed immediately to prevent this discharge. It is expected to improve copper recovery by the dust recovery.

2)-1 Case for Producing Electrolytic Copper and Exporting it

At present, there is few copper fabrication plants in Armenia so the produced electrolytic copper has to be exported.

According to CODELCO of Chile, the export price of electrolytic copper on CIF European port basis is the sum of LME (Cash settlement) and premium (US$ 38/t) for 2003.

To have a premium, conditions such as LME brand and etc., are required and therefore the premium is assumed to be 0 in this study. Also, the export is assumed as to Germany, and the freight is considered as US$115 /t, which is the same as current charge for blister.

2)-2 Case for Producing Electrolytic Copper and Consumption in Armenia

An example of domestic price in Japan is as follows;

Time:	July 2002
LME price:	US$1,648 /t
Import tax:	US$ 82/t

Import cost: US$223/t

Domestic price in Japan: US$1,953/t

Domestic price in Armenia is calculated without the import tax under an assumption of the same import cost as Japan, as follows:

US$1,648/t + US$223/t = US$1,871/t

From the viewpoint of the sales price, the electrolytic copper can be sold at a higher price than the LME price if locally consumed. (For example; The Armenian domestic price of copper imported from Iran in November 2002 was the sum of LME price and US$240 /t.)

From the standpoint of the users of electrolytic copper, their products will be cheaper and more competitive in international market, if the can get electrolytic copper at lower price in Armenia. In the long-term view, the development of downstream industries may be expected. In the study, the domestic price is assumed to be the LME price, and the transportation cost is assumed as US$35/ton.

(3) Result of the Case Study

The results of study are shown in Figure 3-4-1 and Appendix 3-19. ACP can make profit from the production of blister if the LME price is more than US$2,400/t.

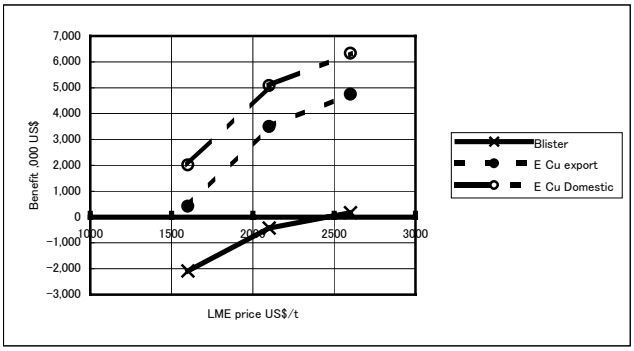


Fig. 3-4-1 Result of the Case Study

When produced electrolytic copper is exported, ACP can make profit if the LME price is more than US$1,600 /t. For this case, however, about US$20 million is required for the reconstruction of a tankhouse. The recovery period of the construction cost of the tankhouse is shown in Table 3-4-2.

Generally any project is considered as very good if the recovery period of construction cost is less than 3 years. In the LME price is 2,600 US$/ton, the case of domestic sale nearly corresponds to that.

Table 3-4-2 Return Period of the Construction Cost (years)

LME Price	Export	Domestic Sale
US$1,600/t	48.1	10.0
US$2,100/t	5.7	3.9
US$2,600/t	4.2	3.2

4-2 Copper Production in Armenia

As mentioned above, the current domestic consumption of copper is not large in Armenia

so it is not practical to study the copper production considering only domestic consumption. But it is possible if the consumption area is expanded to the Caucasus because there is no copper production facility in this area.

Possibility of copper production in Armenia is discussed here from various points.

(1) Supply of the Copper Concentrate

The copper production in concentrate from Armenian mines in 2001 is shown in Table 3-4-3

Table 3-4-3 Production of Copper as Concentrate

Kajaran mine	11,430 t
Agarak mine	3,989 t
Kapan mine	985 t
Total	16,404 t

In 2001, 10,000 t of copper was produced in Georgia so the total production is 26,404 t. The private mine, Alaverdi Mine, has a yearly production plan of 2,400 t copper from May 2002, and so the final total is estimated at 28,800 t.

The current yearly production of blister planned by ACP is 30,000 t so the total concentrate produced in the Caucasus almost meets to it.

1) Copper Consumption

Copper consumption is said to be generally influenced by economical factors like industrialization as well as social factors like the increase of population. Copper consumption per capita and GDP in major countries in the world are shown in Table 3-4-4. The relationship between copper consumption and GDP is attained by plotting the table, shown as Fig. 3-4-2.

Table 3-4-4 GDP and Copper Consumption in Major Countries

Country	GDP US$ per capita	Consumption Kg per capita
Japan	37,000	11.9
North America	27,500	9.3
Europe*	23,000	8.5
Oceania	21,000	8.5
Asia**	500	2.1
South Africa	4,000	1.3
Africa	1,000	0.1
India	500	0.1
Central America	500	1.4
China	1,000	1.6
Europe (others)	2,500	1.8

N.B. *EU, Norway and Switzerland **excluding Japan, India and China

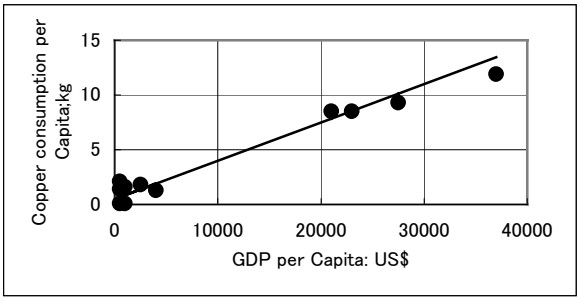


Fig. 3-4-2 Relationship between GDP and Copper Consumption

Copper consumption in Armenia, Georgia and Azerbaijan are estimated from the figure and shown in Table 3-4-5. In the table, the copper consumptions 5 and 10 years later in Armenia,

Georgia and Azerbaijan are estimated with 10%, 3% and 10% GDP growth rates. The maximum domestic consumption in Armenia will be about only 7,000 tons in 10 years, but the total consumption in the Caucasus will reach up to 26,000 tons.

Table 3-4-5 Estimated Copper Consumption in the Caucasus (as of 2000)

Country	GDP	Consumption	Population	Current	Copper Consumption in future		
	US$/capita	Kg/capita	Million	Consumption	Growth	In 5 yr.	In 10 yr.
Armenia	503	0.676	3.8	2,569 t	10 %	4,137 t	6,663 t
Georgia	555	0.694	5.1	3,541 t	3 %	4,105 t	4,758 t
Azerbaijan	507	0.677	8.1	5,487 t	10 %	8,837 t	14,233 t
Total	—	—	17.0	11,597 t	—	17,079 t	25,654 t

2) Current Mining Industries in the World

Copper business is not local, but global. Its current situation is explained in short as follows.

i) Global Copper Business Trend

Production in mines, smelters, refineries, SX-EW and fabricators in major countries in 1999 is shown in Appendix 3-20. All advanced industrialized countries are included in the table. If Armenia also wishes to have a long- term development of its industries, it should produce electrolytic copper and invite fabricating companies.

ii) International trade of copper concentrate and electrolytic copper

Regarding trade of copper, the concentrate and electrolytic copper are common, but the blister or anode is rare. Countries ranking for export and import of copper concentrate as well as of electrolytic copper in 1998 are shown in Appendix 3-21.

a. Export as copper concentrate

Difference of copper production between mining and smelting is the exporting quantity of the concentrate. Chile is the largest copper exporter with 3,054,000 t. Chile also produces electrolytic copper, but its domestic consumption is negligibly small and almost all of it is exported.

b. Export as electrolytic copper

Chile is also the largest exporter of electrolytic copper. Australia also exports much as electrolytic copper.

c. Import of concentrate

Japan has no copper mine and imports almost all copper by concentrate to produce electrolytic copper and fabricate it. Japan sometimes imports electrolytic copper and exports it according to demands and needs based on the global economy.

d. Import of electrolytic copper

Italy, Japan and Germany import the concentrate and produce electrolytic copper in their smelters, but the consumption for fabricating is also large so they also import electrolytic copper. France and Taiwan have no smelter.

The present Armenia is judged to be close to the Category an export as concentrate. Blister will not lead to the development of fabricating industry.

3) Production Expansion Plan and Pollution Control at the Alaverdi Smelter

There is only one copper smelter, the Alaverdi Smelter of ACP, in Armenia. Its production

scale is, however, small and no practical countermeasure against pollution has been taken. Here some production expansion plan and pollution control measures are described.

a. Production Expansion Plan

Outokumpu submitted to ACP a plan, which intends to expand yearly production to 40,000t/y (30,000 t from concentrate and 10,000 t from scrap) and also recover SO_2 gas as sulfuric acid by investment of 44 million EUR (US$43 million). However, how to treat the produced sulfuric acid is a serious problem to be solved. Total yearly production of sulfuric acid is estimated to reach up to approx. 99,000 t.

ACP decided against the above plan to adopt an INCO furnace. This new plan intends to have yearly production of 30,000 t (27,500 t from concentrate and 2,500 t from scraps)

b. Pollution Control

Recovery of SO_2 gas must be done very urgently by ACP in order to prevent environmental pollution. On the hand, as a private enterprise profit is also very important for ACP.

A purchase price of sulfuric acid in Yerevan was US$128/t in November 2002. Direct production cost (exception of depreciation, tax and interest) of sulfuric acid is calculated to be approximately US$15/t. Total cost for sale is estimated at US$55/t with an assumed inland transportation cost of US$40/t, and a profit of US$73/t is possible. Accordingly a yearly profit of US$7,200,000 is possible by the production of 99,000 t. At present, however, the sulfuric acid consumption in Armenia is small so almost all of the produced sulfuric acid must be exported.

In case of exporting it to Europe, US$120/t is needed for transportation using a special container, and the total cost will be US$135/t with a production cost of US$15/t. But the standard price of sulfuric acid in Europe is estimated at US$100/t, thus US$35 /t will be a loss. This business is not feasible.

Therefore, Armenia must create industries that locally consume sulfuric acid and also study the consumption in all areas of the Caucasus.

In order to produce sulfuric acid, a minimum 4% SO_2 concentration in the gas is required, but the gas from a reverberatory furnace used at the Alaverdi Smelter has only a 1 to 2% SO_2 concentration. The cost for the high SO_2 gas generation process equipment is included in the US$43 million investment for the production expansion mentioned above.

c. SX-EW

Direct recovery of copper from copper oxide by SX-EW needs a large quantity of sulfuric acid. Some industrial applications of SX-EW have already been done for certain sulfide ores, but a process for chalcopyrite that is common in Armenia is still in the testing stage. There is oxide ore in the undeveloped Tekhut and Aygedzor deposits, which may have application of SX-EW. The result of sulfuric acid consumption for SX-EW in the world is shown in Appendix 3-22.

4-3 Possibility of Smelter Construction in Armenia

Copper mines are located mainly in the southern part of Armenia so transportation cost can be minimized if there is a smelter in this area. But the initial investment for construction of pyro-metallurgical smelter will be a vast amount. A rough estimate for a pyro-metallurgical plant

with a pollution control facility will be approx. US$250 million for a yearly capacity of a 30,000 t electrolytic copper. A rough estimate for a hydrometallurgy plant using SX-EW with a yearly capacity of 30,000 t electrolytic copper will be approx. US$130 million which is lower than the pyro-metallurgical plant. However, a SX-EW plant has several limitations for construction. For example, the SX-EW plant treats not concentrate but crude ore directly so it must be located nearby the mine. In the southern area, three plants will be required for three mines. But as mentioned above, chalcopyrite, which is common in Armenian mines, is still in research stage for economical recovery copper so it is impossible to adopt SX-EW immediately.

Infrastructures are already equipped at the Alaverdi Smelter so it can be modified to a pyro-metallurgical plant with a yearly production capacity of 30,000 t from the copper concentrate and the estimate cost will be US$ 43 million according to the Outokumpu estimate.

4-4 Conclusions and Recommendations

As mentioned above, the issues of the Alaverdi Smelter are two points, the exhaust gas pollution and the fact that its final product, blister, is only an intermediate product of smelting.

At present, there is little domestic demand in Armenia for electrolytic copper and sulfuric acid produced from pollution control facility. Exporting sulfuric acid will not be profitable due to high transportation cost.

SX-EW is one of the solutions, but it still in the technical development stage in the world so its trend must be observed keenly. Much research on bio-leaching had been reportedly carried out during FSU time in Armenia. Further research and development must be continued utilizing fully the past basic research. If the research turns out successful and SX-EW is applied at the southern mines to produce electrolytic copper at a production cost of 50 ¢ /lb as shown in Table2-12-2, the mines will be profitable at low a LME price of US$1,560/t (70 ¢ /lb).

Copper smelting business is greatly influenced by the copper price of LME. The copper mines and smelters over the world are struggling against the current low price so now is not a good time to make a new investment. But this situation will never last for a long time.

Labor and utility costs are comparatively low in Armenia, which offers an economical advantage for industrial operations. If sulfuric acid and electrolytic copper can be supplied at low cost, it will be possible to develop and invite several industries. Accordingly, from a long-term view, both sulfuric acid and electrolytic copper are essential as basic materials for industrial development in Armenia and the demand in Caucasus can also be considered. It is recommended to produce electrolytic copper at the Alaverdi Smelter by a process taking into account the profitability.

An action program is proposed to solve the issues of the Alaverdi Smelter. The action program is divided to two stages, reconstruction and development stages. In the reconstruction stage, the electrolytic copper production and the construction or invitation of a copper manufacturing plant will be started. At the same time the sulfuric acid usage will be tested. In the development stage, the Alaverdi plant capacity will be increased with pollution control under consideration of the results of market research and test for electrolytic copper and sulfuric acid consumption in Armenia. At the same time, SX-EW plants will be constructed at mine site if the result of leaching test is good. The

content of the action program is shown as follows:

1) Investment Cost (rough estimate)

Reconstruction stage

1)	20,000t/y tankhouse	US$ 20 million (include anode furnace and casting)
2)	De-dust equipment	US$ 1 million
	Total for Reconstruction stage	US$ 21 million

Development stage

3)	Additional 20,000t/y tankhouse	US$ 5 million
4)	Production expansion of smelter to 40,000 tons per year, and recovery of SO_2 gas as sulfuric acid	US$ 43 million (by Lurgi Proposal)
	Total for Development stage	US$ 48 million

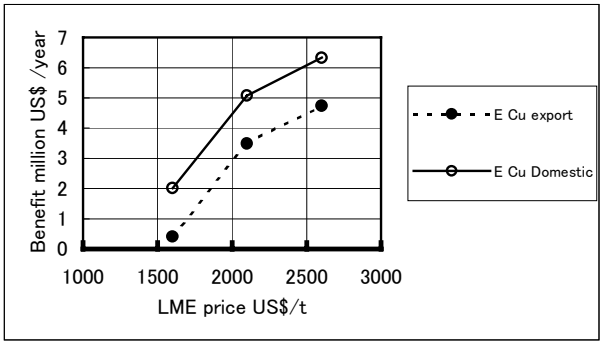
2) Reconstruction Stage (five years)

- 1) 20,000 t/y tankhouse
- 2) Improving the efficiency of exhaust gas dust collection at the smelter

The effect by the above 2 items is shown in Fig. 3-4-3

In case all produced copper is consumed in the domestic market and US$ 2,100 per ton of LME price, the operation profit (before depreciation, tax and interest) is about US$ 5 million per year and the investment cost of US$ 21 million is recovered in about 4 years. But if all copper is for the export market, the profit reduces to US$ 3.5 million per year and the recovery period will be 6 years.

Fig. 3-4-3 Investment of 21 million US$



- Construction of a copper fabricating plant
- Development of sulfuric acid usage (leaching tests)

2) Development Stage (five years)

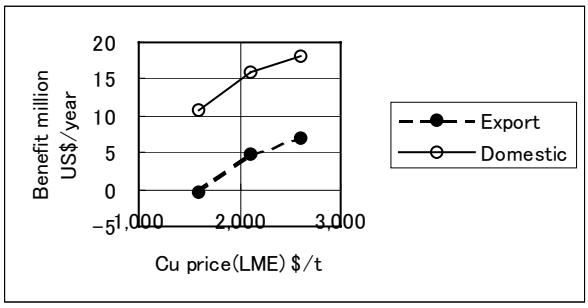
- 3) Expansion of tankhouse by 20,000 t/y capacity
- 4) Production expansion of smelter to 40,000t/y, recovery of SO_2 gas as sulfuric acid

The effect by the above 2 items is shown in Fig. 3-4-4.

In case all produced copper and sulfuric acid are consumed in domestic market, and US$ 2,100 per ton of LME price, the operation profit (before depreciation, tax and interest) is about

US$ 16 million per year and the investment cost of US$ 68 million (including item 1) and 2)) is recovered in about 4 years. But in case all electrolytic copper and sulfuric acid are for the export market, the profit reduces to US$ 5 million per year and the recovery period will be 14 years.

Fig. 3-4-4 Investment of 68 million US$



Other conditions for the above calculation are shown below.

	Copper	Sulfuric acid
Production ton/year	40,000	99,288
Price US$/ton		100
Transportation cost		
for export	115	120
for domestic	35	40

Copper material; from concentrate 30,000 tons per year

from scrap copper 10,000 tons per year

- Increasing copper fabricating plants
- Construction of SX-EW plants (by result of the feasibility study)

5. Analysis of the Managerial Situation of Two Mining Enterprises using Key Indices

Managerial analysis was done for two mining enterprises, the Kapan Mine CJSC and Alaverdi Smelter (Armenia Copper Program - ACP CJSC).

This section reports the results of the business analysis of the two enterprises by calculating key managerial indices from the financial data, namely the profitability, financial stability, utilization of assets and capital, growth potential and productivity.

The study team visited the two enterprises and requested financial statements for the past five years. The study team obtained from a financial executive of the Kapan Mining Complex the balance sheets and the profit and loss statements for three fiscal years between 1999 and 2001. Financial data on the preceding years were requested, but due to the change in management and an acquisition plan by a foreign company, which occurred after November, we have not obtained them still now. Thus, managerial indices were calculated for the three fiscal years (Appendix 3-23). On the other hand, ACP CJSC was privatized in 1999 and prepared financial statements (balance sheet, profit and loss statement, cash flow statement, and schedule of capital) according to the international standards for FY2000 and FY2001. The financial statements for the two fiscal years are based on different principles and contain different items from those in financial statements for the preceding years, making direct comparison difficult. As a result, managerial indices were calculated for

FY2000 and FY2001 only (Appendix 3-24).

Although sufficient financial data to allow a detailed analysis and corporate diagnosis were not given, an attempt was made to conduct preliminary analysis of the two enterprises on the basis of financial statements and other information obtained through interview surveys of the management including financial officers. The results of business analysis using managerial indices are summarized as follows.

5-1 Kapan Mine

(1) Profitability

A loss was reported for three consecutive years from FY1999 to FY2001, indicating that it is difficult to regain profitability.

(2) Financial Stability

The capital decreased significantly between FY1999 and FY2001, and it turned negative in FY2001. The value of non-current (fixed) assets is disproportionately large compared to the capital and reserves, while current liabilities far exceed current assets. Thus, the financial condition is not healthy in short and long terms. The ratio of borrowed money to revenue is very high.

(3) Utilization of Assets and Capital

As the revenue grew between FY1999 and FY2001, the turnover rates of total assets, non-current (fixed) assets, receivables and inventories turned upward slightly, but they remain at very low levels.

(4) Growth Potential and Productivity

Productivity per employee grew during the three-year period due to the increase in revenue. Nevertheless, the revenue per employee in FY2001 is still at a very low level equivalent to 15.6% of revenue per employee earned by ACP.

(5) Overall Evaluation

Kapan CJSC reports a loss, holds large liabilities and excessive fixed assets, and is in a very unstable financial condition. Due to the limited working capital, it cannot always buy parts and consumables required for production. In fact, the shortage of materials and parts forced a production shutdown for a few months in FY2001 and FY2002. The company is behind payment of electrical charges and wages. Overall, it is in a critical condition and cannot recover from the situation by itself.

(6) General Direction for Improvement

It is imperative to develop a reconstruction plan and start restructuring efforts, such as disposal of fixed assets and significant reduction of workforce, which should be carried out urgently. In addition, as a loss is continuously generated with no prospect for improvement and large debts create the shortage of operating funds, the sales of the entire company to a foreign investor should be a feasible way to save the company and keep it going. At the end of November 2002, it was announced that Deno Company of Switzerland planned to invest $8 million in Kapan CJSC.

5-2 Alaverdi Smelter (ACP)

(1) Profitability

The gross profit to revenue (gross profit ratio) declined from 15.4% in FY2000 to 5.3% in FY2001. As a result, the operating profit to revenue and before-tax profit to revenue in FY2001 have negative figures, minus 14.7% and 18.8% respectively. At the same time, the administrative cost to revenue almost doubled in FY2001 to 14.2%, squeezing the operating profit.

(2) Financial Stability

As the capital and reserves increased by 140% in FY2002, their percentage share of total assets soared to over 50%. Meanwhile, the value of fixed assets (e.g., land, buildings, plant and equipment) increased by 12.9 times in FY2000 in consequence of revaluation. As a result, the non-current assets (fixed assets) to capital and reserves rose to 147.7% and the non-current assets to capital, reserves and long-term liabilities to 138.1% in the same year. This means that ACP holds excessive fixed assets in comparison to the fixed capital that can be utilized in the long term, making its financial condition less stable.

In addition to the rapid rise in the fixed asset ratio and ratio of fixed assets to long-term capital, current liabilities doubled in FY2000 and the ratio of current assets to current liabilities plummeted from 160.0% to 48.5%. This implies that some of equipment funds have been financed by short-term loans, creating concern about short-term solvency.

(3) Utilization of Assets and Capital

ACP increased total assets by 2.6 times in FY2001 as a result of reevaluation, but its revenue declined by 14.3%. As a result, the turnover rates of operating capital, non-current (fixed) assets, and inventory declined to indicate that ACP does not utilize its assets and capital effectively.

(4) Growth Potential and Productivity

While the revenue declined by 14.3% in FY2001, the number of employees grew from 460 to 680. As a result, the revenue per employee fell 42.0%.

(5) Overall Evaluation

The managerial indices in FY2000 and FY2001 show deterioration. Profitability decreased significantly in FY2001. The gross profit to revenue became one-third that in FY2000, and the operating profit to revenue turned to negative. On the other hand, sales and administrative costs grew sharply partly due to the increase in the number of employees. In FY2001, while ACP increased its capital by 2.8 times, fixed assets were reevaluated to increase by 12.9 times, resulting in the excess asset value over the capital and making the financial condition less stable. Furthermore, current liabilities grew rapidly in FY2001 to decrease the short-term solvency. Finally, the rapid increases in assets and capital, coupled with the revenue decline caused their utilization and productivity to deteriorate significantly.

It should be noted, however, that deterioration of the managerial indices was largely caused by reevaluation of fixed assets at the end of 2001, which appreciated considerably due to the country's transition to a market economy. In fact, reevaluation will be conducted every five years by a government-authorized appraiser. It is made on the basis of market prices, which are applied to land, buildings, and plant and equipment. If no fair market price cannot be assessed, valuation is

made by subtracting the depreciation cost from the replacement cost. The rapid increase in the value of fixed assets as a result of reevaluation is evident from the appendices attached to the financial statements. In particular, the value of land and buildings increased by 35 times over that in FY2000 and accounts for 69% of total fixed assets (after depreciation). On the other hand, the value of plant and equipment increased by 3.5 times due to reevaluation and represents 26% of the total. Overall, reevaluation was made on the basis of actual market conditions and the high rate of increase is considered as the "adjustment" of the value of fixed assets that occurs with the country's transition to a market economy.

ACP's accounting rules require the accumulated appreciation for real estate (excluding land), plant and equipment to be adjusted according to their value after reevaluation. Also, ACP plans to depreciate its buildings, plant and equipment, and other fixed assets by the straight-line method. If depreciation is made as planned, the financial condition can be improved over the temporary down turn in FY2001.

(6) General Direction for Improvement

To improve ACP's business condition, profitability should be given the first priority. For raising profitability, revenue should be increased and/or the production cost should be reduced to increase the gross profit to revenue. To increase the revenue under the present production system, market development and expansion is indispensable and efforts to reinforce marketing and sales capabilities are essential. Cost reduction is discussed in detail in another section. Revenue growth and cost reduction will raise profitability to allow ACP to reduce current liabilities and improve its solvency.

To stabilize the financial condition in the long term, it is imperative to dispose fixed assets that are not used or underutilized, while ensuring effective and efficient operation and utilization of fixed assets required for business activities. Rationalization of fixed assets should be carried out according to the following steps.

1) To develop a medium- and long-term business plan (for 3-5 years, covering production and sales, revenue and expenditure, organization and manpower, and investment).
2) To assign a serial number to each fixed asset (plant and equipment), and prepare a fixed asset register that records data and information on each asset including the name, use, function and capability, date of installation, purchase price, and depreciation status. For efficient management, a computer should be used.
3) To analyze the operating history of each asset in the past three (five) years and classify all assets into three categories, "to be disposed," "to be sold" and "to be used." Classification should be made by taking into account the long-term business plan and its requirements.
4) To promptly dispose or sell the assets so classified and put the proceeds into a reserve or pay for short-term liabilities.
5) To check each asset "to be used" each year and take necessary action to ensure its effective use.

CHAPTER 4 GRASPING RECENT CONDITIONS OF MINING INDUSTRY AND SUBJECTS OF ITS PROMOTION

CHAPTER 4. GRASPING RECENT CONDITIONS OF MINING INDUSTRY AND SUBJECTS OF ITS PROMOTION

1. Subject

Armenia has a basement of the mining industry such as exploration, development, production, smelting (Copper and Molybdenum) and manufacturing that covers a comprehensive territory. Also knowledge and technology is accumulated in Armenia. However, in moving to a free market economy, Armenia needs to arrange and restructure its existing basement and system.

The subject embodiment of the policy of promotion of the mining industry covers on the whole such as economy, administration, production, market, etc. based on grasping the actual condition of the mining industry.

- Arrangement of administration of mining industry
- Reconstruction of system of production and competition in a free market
- Construction of State financial basement
- Formation of financial market
- Promotion method of mining industry by using characteristics of resources
- Promotion of the downstream copper business

2. Understanding Actual Condition of Mining Industry

The examination of the promotion of the mining industry has been done through a survey on the recent conditions and case study that covered items on the basement and production fields of its mining industry (Table 4-2-1).

Table 4-2-1 Present Condition of the Mining Industry

Item	Present Condition	Subject
Government budget of mining industry	Limited tax revenues just used for maintenance of government and administration organizations. No investment to mining industry. Large debt	Reinforce government loan (especially long term T-bills) Investment to mining industry
Tax system	VAT high rate	Privilege, tax system for mining industry investment
Mining laws	Enforcement of new Concession Law and Subsurface Code	Arranging mining law regulations
Mining Policy	Described in new mining laws	Consistency new mining laws with related laws
Mining organization	Dispersed, functions are insufficient	Unification, make efficient
Investment	Insufficient progress of foreign capital to private mining sector. Negotiation on definition of tax	Information disclosure. Policy for favorable treatment of investment.
Finance	Immature. Only short-term finance (interest rate high). Small stock business. Small scale government loans.	Increase trust of financial organizations Legalize illegal funds
Privatization	A part implemented. In progress	Privatization items. Asset evaluation
Infrastructure	Road repair, open facilities. Repair electrical facilities.	Decrease electricity fee. Arrange road network.
Mining impact on environment	Environmental problems but actual condition unclear. Arrange laws related to environment.	Survey environment, make measures
Mining training	Mining industry decline along with decrease of students. Raise superannuated facilities.	Reconstruct mining industry
Mining operation management	Difficulty supplying capital with partial recovery of production. High costs. Unprofitable selling concentrate.	Supply capital. Improve selling of concentrate. Reduce costs
Exploration, development	Activity stagnated from lack of capital. Foreign investment partially implemented.	Arrange information. Supply capital.
Exploration technique	Old. Start casting off USSR technical evaluation methods	Introduce technology. Spread technical evaluation.
Mine smelter technology	Insufficient systemization and functions	Introduce systemization and automation
Production	Superannuated broken down facilities	Renew facilities. Quality control
Resource information	Access difficulty. Not arranged. Insufficient disclosure.	Disclose information on facility on web site.

- Government organizations (including administration) are dispersed and do not function
- Policy of the mining industry is described in new Concession law and Subsurface Code as mining sector development through foreign and domestic capitals.
- Reconstruction of mines and smelting plants has started, but there are difficult conditions to raise and create funds. Strategy of the mining industry business is insufficient.
- To access information is not easy because of insufficient arrangement of information. Arrangement of information is a subject for promotion of foreign capital.
- There are many hindering factors for exploration and development (funds, information, investment, right of possession such as mining rights)
- Administration and law for environment is being arranged, but still now there are few considerations for the protection of the environment by mining industry activities.

Understanding the actual conditions of the mining industry makes it indispensable to solve the problems in the financial and economic fields that support the mining industry as well as mining problems in Armenia.

3. Examination of Promotion Measures on Mining Industry

3-1 Position of Mining Industry and its Role

Now the mining industry shows a 2.7% share in the GDP because economic activity in a free market is being promoted and the economic basement is weak. It is not expected to increase the State budget by tax revenue and T- bills, etc. in the actual situation. The GDP will increase if the reconstruction of existing mining industry and promotion of exploration and development by using resources in Armenia. The mining industry is a powerful industry having the possibility to contribute to the economic development in every industry. Therefore it is needed to make the mining industry as a target field for priority investment by the State budget especially metal resources in the mining industry is a type of industry for acquiring foreign capital..

3-2 Policy for Making Master Plan

The Master Plan for promotion of mining industry is for 10 years and divided into two stages. The first half of the Master Plan, 5 years, is the stage of reconstruction. The latter half is the stage of development that needs an effective systematization to be connected with the comprehensive mining promotion by the Master Plan (Table 4-3-1).

- Reconstruction stage (0-5 years): Arrangement of basement field, arrangement of investment condition, reconstruction of production field. Recovery of productivity should be aimed by the promotion of reconstruction of the mining industry basement corresponding to a free market economy. In this stage, a comprehensive feasibility study on a copper smelter should be done to decide the production scale by means of expanding or constructing a new smelter.
- Development stage (5-10 years): Promotion of exploration and development, increase production. It is needed to raise domestic capital by strengthening the comprehensive system from exploration, mining to smelting by increasing the production amount and structuring the production activity considering the environment.

Table 4-3-1 Concept of Mining Promotion Measures

Item	Reconstruction Stage	Development Stage
Policy, system	Draft, establishment of system, implementation	Revise, improve, intensive advice from private sector
Investment environment	Establish favorable treatment tax system	Raise private capital
Financial market	Establish long-term finance, large stock market	Establish financial market
Tax system	Reduce VAT, etc, favorable tax treatment to investment	
Mining law	Revise, enforce	Solve problems that occur
Government organization	Construct and practice unified organization	Improve to the most suitable organization through review
Infrastructure	Arrange basic infrastructure, reduce electric power rate	Arrange infrastructure of mining industry
Education	Repair, renew and arrange equipment and facilities	Introduce training from market economy country
Exploration	Establish and put into practice an exploration subsidy system, introduction of technology	Geological map, arrange basic maps of distribution of resources, etc.
Mine	Reconstruct existing mines, renew facilities and machines, introduce technology	Development supporting system, Improve operation management
Smelter	Expansion, ascertains its establishment.	Engineering, construction
Environment	Introduce monitoring equipment, construct management system	
Copper manufacturing industry	Expand present manufacturing production, business examination	Execute F/S
Resource information	Implement disclosure, add information	
Capital	Prepare and establish mining fund	Operation of fund

3-3 Target and Basic Policy for Mining

Copper, molybdenum and gold should be the targets based on the characteristics of the existing mining industry and resources in Armenia. A consistent system from ore to metal by expanding the existing facilities and construction of new facilities in the copper industry should be considered to be built if the market of sulfide acid can be embodied.

- The mining industry makes links with the development of the Armenia economy and local society and promotion of employment.
- Promote mining industry with environmental protection.
- Copper, molybdenum and gold as international products are priority kinds of metals - to aim at acquiring foreign currency.
- Strengthening of competitiveness should be attempted by the establishment of the production system in the copper industry in the early stage (30,000 tons per year), and construction of production system of polymetal and gold deposits.
- Arrangement of production system in a free market economy by acquiring new knowledge and technology by the introduction of foreign capital.

3-4 Guideline for Production

Guideline for production should be made to evaluate its achievement of the measures for mining promotion. When necessary, mining policy and promotion measures should be improved for the complete achievement of the guideline. The guideline must be connected with mining and industrial policies. From resources, potential and production results, a realistic production guideline is as follows,

- Mining share in the GDP will be more than 10% after 10 years.
- Yearly production of copper will be more than 50,000 tons and gold more than 5 tons after 10 years.

3-5 Basic Policy for Promotion Measures

The promotion measure for realization of the Master Plan is basically to be implemented, to be managed and to be checked the condition of implementation by the Armenia government. The promotion measures in the reconstruction stage are an action program and implementation of mining policy (Fig. 4-3-1). However, support and cooperation of international organizations and each country are also needed because of the national deficit structure and money shortage for arrangement.

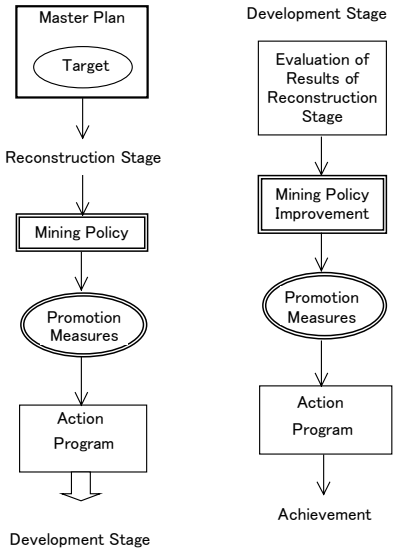


Fig. 4-3-1 Stages of the Master Plan

- Privatization, recovery of productivity and arrangement of environment on introduction of foreign capital investment and on promotion of exploration and development are important priorities in the reconstruction stage.
- Development by domestic capital, strengthening of competitiveness for production and establish by implementation of environmental management are priorities in the development stage.
- Examination of embodiment and possibility of realization of proposed promotion measures are needed for making the realization of the promotion measures.

3-6 Master Plan (Basic Plan)

Two stages consist of reconstruction and development, as mentioned before. Each stage should be carried out in a concrete form to achieve the guideline. Essential feature of the Master Plan is shown in Table 4-3-2.

The Master Plan was made by means of reconstructing and developing copper, molybdenum and gold mining as the center of the Armenian mining industry to activate and promote a comprehensive mining industry, taking into account of the guideline (Table 4-3-3). The content of the promotion plan that consists of the Master Plan will be explained in the chapter of Mining Policy and Promotion Plan.

Table 4-3-2 Outline of the Master Plan

Stage	Reconstruction	Development
Term	0-5 years	5-10 years
Guideline	Copper 30,000 tons per year, gold 3 tons per year, 5% of GDP	Copper 50,000 tons per year, gold 5 tons per year, 10% of GDP
Copper business	F/S, business plan	Engineering, construction, each component F/S
Privatization	Finished, management improvement	Independent company without support, growth, growth of domestic capital
Introduction of foreign investment	Arrangement of basement for receiving foreign capital (arrangement of investment environment)	Promote exploration and development by foreign capital
Government organization	Arrange uniform system	More functions
Budget for mining industry	Budget for reconstruction	Budget for promotion
Change to IT	Arrangement of basement of web, GIS, database	Expansion and use
Target for increasing employment	Development of new deposit, create business related to IT	Creation by expansion of smelting plant, and exploration and development
Scale for investment (state budget, foreign investment, domestic capital, international organizations, etc. Total	US$100 million	US$200 million

Table 4-3-3 Master Plan

Year		1	2	3	4	5	6	7	8	9	10
Period		Reconstruction period					Development period				
Cu-Business	Target, smelting	F/S preparation		Implementation of F/S		Rise of Funds	Repair & installation of environment protection facilities for smelting		Establishment of fertilizer & sulfur production plants		Decision on construciton of new Smelter
	Production volume	Cu - 20 thou.t		Cu -30 thou.t			Cu - 40 thou.t		Cu - 50 thou.t		
	Mine	Privatization / Investments & Management Improvement		Management improvement. Establishment of production expansion system			Implementation of environment protection countermeasures		Stable operation		
Exploration & Development of new deposits (Cu, Mo, Au)		Establishment of Reserves Evaluation system, and exploration system		Development of a new deposit / Promotion of Exploration			Development of new deposits (new mines) / Promotion of Exploration				
Arrangment of Legal & Tax system		Amendment		Confirmation of law enfercement status			Review, Amendment and Addition				
Governemntal Body for Mining Industry		Establishment of Unified Body	Resolution of Problems and Issues		Establishment of Mining Industry Council / Plan implementation based on adopted Policy		Functioning				
Mining Policy & Plan of Development of Mining Industry		Establishment of Study Committee	Policy & Plan Enforcement	Policy & Plan Improvement		Policy reflects private sector's opinion	Evaluation of the results of Mining Industry Policy Policy improved enforcement				
Environmental Countermeasures		Establishment of Environmental Assessment		Implementation of Environmental Assessment Surveys			Establishment & Implementation of Environment Management System				
		Implementation of Environment Pollution Surveys / Establishment of Monitoring System			Creation of Plan of Environment Protection Countermeasures		Implementation of Environmental Countermeasures				
Systematization by IT		Expansion of web-site / Data arrangment		Expansion of Database & GIS			Establishment of Web-Site - Database - Linked System / Use in implementaiton of National Development Plan				
Investment	National budget	Each year US$2-3 million				US$15 million	Each year US$3-5 million				US$20 million
	Foreign capital	US$45 million					US$80 million				
	Domestic capital	US$20 million					US$40 million				
	International org.	US$20 million					US$60 million				
	Total	Total US$100 million					Total US$200 million				
Guideline		GDP 5% after 5 years, copper 30,000 tpy, gold 3 tpy					GDP 10% after 10 years, copper 50,000 tpy, gold 5 tpy				

3-7 Action Program

To examine of the promotion of the mining industry, implementation of the Action Program for 5 years sets forth as is a premise (Table 4-3-4). Action program will be explained in the below further details. Government shall make a budget for implementation of Action Program. Plan, procedure and effectiveness for implementation of each program will be examined at making budget. Promotion plan (Action Program), that is costly and is in need of know-how and technology, will be requested to international organization.

Table 4-3-4 Five year Action Program

Program	Fund and possible assistance	Responsible for role	1st year	2nd Year	3rd Year	4th Year	5th Year
Reform organization (unified)	GB	PMO, MNP, MTED	Fulfillment	Settlement of issues			
Arrangement of mining law (subsurface law & concession law)	GB, EU	MTED, MNP					
Mining policy	GB	PMO, MNP, MTED	Study	Issue			
Council for mining industry	GB	PMO, MNP MTED,		Study	Establishment		
Policy for tax privilege system	GB	PMO, MFE	Study		Enforcement		
Exploration system	GB, IO	MFE, MNP	Study	Drawing	Enforcement (Introduce of foreign capital)		
Privatization	GB, IO	MFE, MTED MP	Introduction foreign capital Sale of mining enterprises		Improvement of management		
Introduce of foreign capital	GB	PMO, MFE, MTED		Arrangement	Disclosure of information Investment seminar		
Improvement of management	EBRD, GB	MTED	Request	Introduction of TAM			
F/S for copper business	GB, IO, EC	PMO		Preparation	F/S		Raising funds
Environmental research	IO, EC	MNP, MTED	Request	Research		Study of measures	
Arrangement of monitoring system	IO, GB	MFE, MNP, MTED		Preparation	Disclosure of information		
Arrangement of mineral information	IO, EC	MNP	Request	Arrangement	Execution		
Training system of human resources	GB, IO	PMO, MNP, MTED		Study	Set up	Execution	
Organization of association of mining industry		MNP, MTED	Study	Set up			
Organization of resources information center	GB, IO	MTED, MNP		Study	Set up		

GB: Government budget, EU: Europe Union, IO: International organization, each country of EU, PMO: Prime Minister office, MFE: Ministry of Finance and Economy, MTED: Ministry of Trade and Economic Development, MNP: Ministry of Nature Protection, MP: Ministry of State Property, EBRD: European Bank for Reconstruction and Development

4. Policy for Mining Industry

The establishment of a mining policy and leadership by the administration is indispensable to realize the promotion of the mining industry in the condition of a financial market that is immature and investment environment that is not arranged on its transition to a free economy.

The course of the mining industry in Armenia is development by the private sector with foreign capital, arrangement of investment conditions based on international law system, privatization of state-owned enterprises, and receiving fair value for the leasing of mineral resources.

The mining policy should be possible and reasonable for realizing the reconstruction stage of the first term and the development stage of the latter term in the Master Plan. The Master Plan of the latter stage is needed to be drafted based on the result of the reconstruction stage. The role of government is to promote investment by mining companies through implementation of mining policy and regulation to control the private sector's activity for protection of the public's benefit. The mining policy in the first term, reconstruction stage, which is now proposed, is as follows.

(1) Promotion of Privatization with Step by Step and the Raising of Domestic Capital

Step by step privatization (Fig. 4-4-1). There are two ideas for privatization of existing national mining enterprises. One idea is to sell them to the foreign investors by tender or negotiation. Another idea is to improve the current managing situation and sell them to domestic or foreign investors. If current situation is improved, sales price of the mine will become high and also will sell more easily. Sales amount must be partially used to reconstruct national mining enterprises for promotion of the whole Armenian mining industry.

- Introduction of foreign capital and raise domestic capital
  - －Effective use of the web-site
  - －Maintenance of financial market and settlement of International Accounting Standard
  - －Introduction of foreign capital to large-scale mines (Kajaran, etc.)
  - －Improvement of management and technology to small-medium scale mines (Introduction of EBRD TAM program, etc.)------privatization by foreign and domestic capital.
  - －Companies of survey, exploration and engineering- privatization by foreign and domestic capital --- privatization by foreign and domestic capital, construction of management basement by merger of existing survey and exploration companies.
  - － Introduction especially underground technology and system for strengthening its competitiveness (model mine business for existing mines).
- Government orders (including support from international organizations) to mining industry companies for the promotion of raising domestic capital, the introduction of system with subsidies and establishment of support measure for finance.
  - －Creation and realization of projects related to the mining industry (target is international organizations).

  For reconstruction and promotion of mining industry, the government should create new projects of an international organization like the World Bank by its loan. These projects will be carried out by national survey companies and their management will be improved. Finally Armenian exploration work will be promoted.

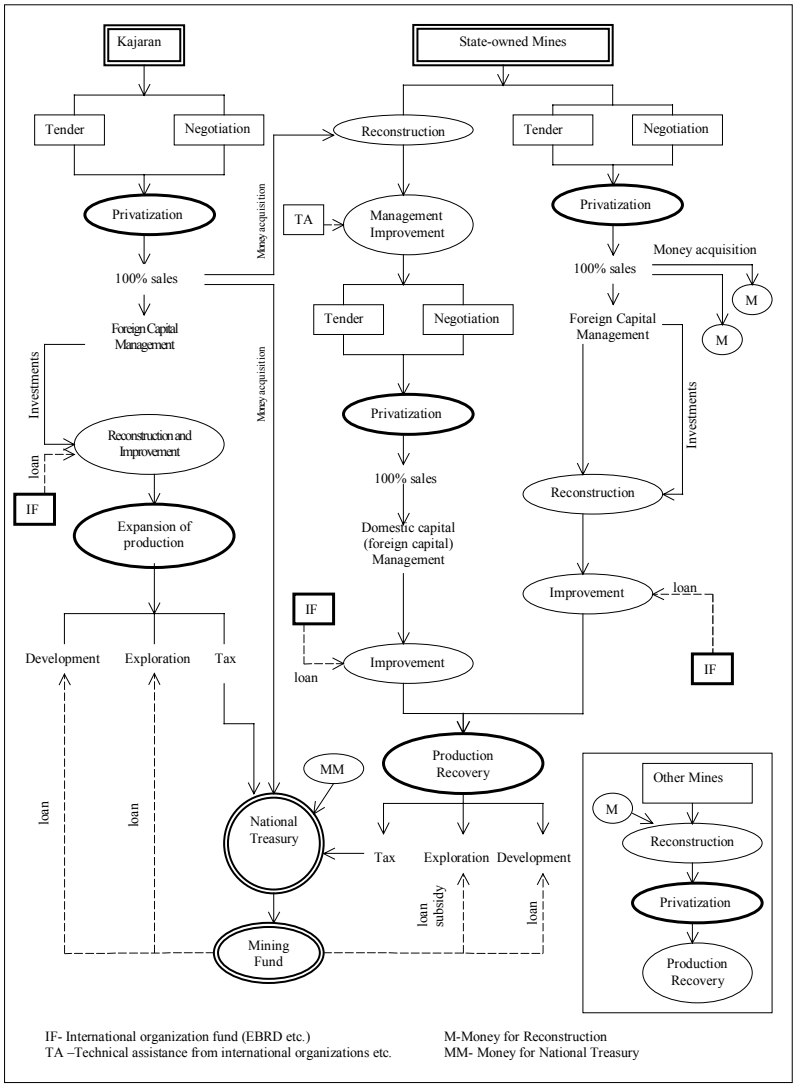


Fig. 4-4-1 Privatization Scheme of State Mining Enterprises

(2) Improvement of Tax System and Public Utility Charge System for Reconstruction of Mining Industry

- Copper, molybdenum and gold, which are directly linked to obtain foreign currency, are given priority as strategic metals. The measure is to establish tax privileges with limited effective periods related to reconstruction (decrease of VAT and excise tax, tax reduction system corresponding to amount of investment, etc.) to mining industry companies.
- Public charge such as electric power rates and energy fees for State priority industries is decreased in a limited period.

－Improvement of management accompanied with reducing costs at existing mines and smelting plants (IT, systemization).

－Transparency of content of management (spreading of international accounting standards).

(3) Arrangement of Condition for Foreign Capital Introduction

- Promotion measure for foreign capital introduction (guarantee of investment by the government, privilege system with limited period and according to scale, transparency of

company accounting, simplify procedure of investment)

- Measure to reduce the tax burden corresponding to the scale of investment.
- Breakdown of investment risk (environment problem) and definite areas of responsibility for risk by the government.
- Disclosure of information and holding investment seminars and exchange technology.

－Disclosure of mining industry information by a website, etc.

－Investor's mining industry seminar in Armenia, EU or USA.

－Invitation of expert from advanced mining industry countries (by an international organization).

(4) Promotion of Exploration and Development

- Supporting measure for the activity of exploration and development by private company (promotion system for exploration and development by using mining fund, lease of instruments for exploration)
- Support system of promotion of development of small-medium scale deposits
- Arrangement of conditions for introduction of small-scale exploration companies (junior companies) of USA, Canada and Australia through the disclosure of information and seminars.

(5) Countermeasures for Environment and Establishment of Management System

- Environmental administration based on grasping of the investigation of the actual situation of environmental pollution (raising environmental survey company, introduction of technology for survey)

－Disclosure of environmental information by the administration side (website, etc.)

－Introduction of environmental survey for grasping the condition of environmental pollution.

－Invitation of expert from advanced mining industry countries (by an international organization)

- Support system for environmental countermeasures and management of environment (loan system for fund of monitoring instruments and facilities, system of information disclosure, instruction of technology for management, etc.)

  It is impossible to prepare environmental measures and an environment protection system under the current economical situation of the Armenian mines so this kind of support is necessary.
- For privatization, definition on the responsibility of past environmental pollution caused by mining operations of national enterprises.

(6) Arrangement and systemization of mining law, tax system related to the mining industry

- Partial review of mining law and arrangement of regulation
- Tax incentive measure for survey and exploration company

5. Promotion Measures

5-1 System of Organization

On the present government organization of the mining industry, drawing up of the mining policy, management of mines, management and issue of licenses, management of work on exploration and development, management of environment and work on research and development, etc. are done in the different organization or ministry. Therefore the functions of activities related to the mining industry are dispersed. There are insufficient conditions for the promotion and management of the mining industry because of the dispersed organization. An organization specialized for mining industry promotion is needed for the realization of promotion measures. It

is desirable to make a unified organization with transparency and moreover it is needed to make clear the role between government organizations, its administration system and private companies on mining activity (Table 4-5-1).

Table 4-5-1 Roles of Government and Private Sector

Item		Government	Private Sector		
		Survey	Exploration	Development	Operations
Role	Promotion measures	Disclose information Mineral resources evaluation Regional Survey Data arrangement	Subsidy Instrument Lease	Loan Supply of interest Tax privilege (accelerated depreciation etc.)	Asset evaluation Privatization Reduction of welfare facilities Decrease electric power rate Improve management (instruction by experts)
	Foreign capital	Economic evaluation of resources of information Cooperation in domestic capital	Technical transfer Raise domestic company (exploration– partial contract	Technical transfer Raise funds Raise domestic compan	Reconstruction of mines (rationalization, renew equipment and facilities)
	Domestic capital	Contract for survey works (government order) Independent survey	Exploration using survey Acquire technoloy	Acquire technoloy Raise domestic capital	Acquire quality conbtrol Acquire management method

(1) Role of Government Organizations and Administration System in the Mining Industry

- Government organizations and administration system have roles to make an environment for activity with sound mining companies and realize mining policy and implement promotion measures for the development of the mining industry. The government has a role to link the development of society and economy by the promotion of the mining industry.
- Private mining companies have independent activity for the mining industry business on survey, exploration, development and production, etc. Mining industry companies have a role for the contribution to the economy and mining industry development.
- Organization of research and development has activity mainly accepting orders from government organizations and mining industry companies.
- NGO like a mining association has a role of indirect support to private mining activities. At same time, it has a role to collect opinions from private companies for the mining policy.
- Promote mining activity with a balance for protection of the environment and life.

(2) Draft of System of Organization

Reorganization of existing mining organizations of the government that are dispersed and unification should be planned (Fig. 4-5-1).

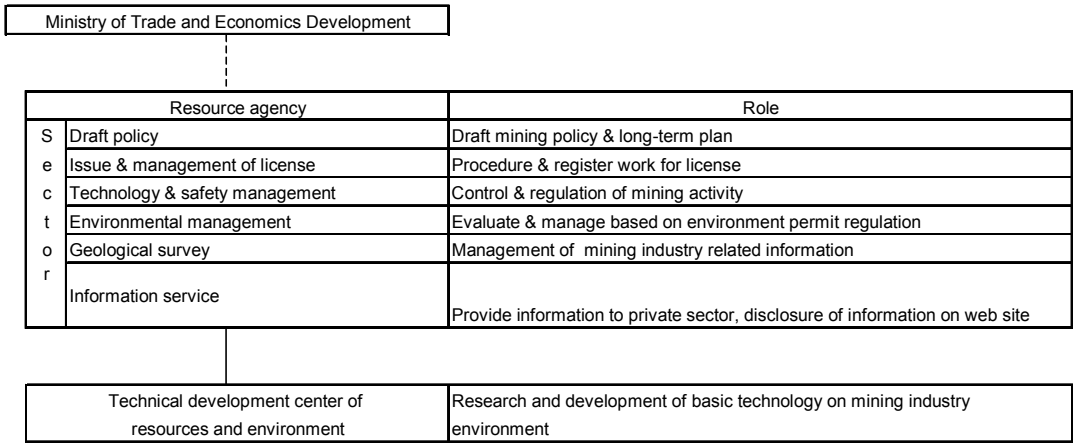


Fig. 4-5-1 One Example of Unified Organization for the Mining Industry

- Unified organization, agency or department level.
- Government organization is mainly administration work. The practical work related to the mining industry activity is ordered to private companies.
- Each section in the mining organization has common information by the introduction of information technology. Networking in the Ministry and related organizations.
- Organization covers the whole mining industry (policy, planning, management, etc.)
- Government work on research and development is mainly for basic technology. Applied technology needs to be ordered to the private sector.
- Environment control depends on environmental management that gives the authorization of mining, and controls EIA (Environmental Impact Assessment) and environmental monitoring.
- Environmental geology, resources economy, and extensive exploration like area geology and ore deposits, exploration planning and evaluation resources depend on geological survey.

5-2 Mining Law and Tax System

New mining laws (Subsurface Law and Concession Law) proposed now needs more improvement with the point of view of simplification, transparency and promotion of introduction of foreign investment, etc. for being accepted internationally. On the tax system, method of promotion for development to a strategic and priority industry should be taken.

Generally speaking, resources development demands a long term (five to ten years) and much capital. At the same time, the recovery of investment needs a long time. Much money is necessary to reconstruct existing mines for productivity recovery. Accordingly the financial burden for reconstruction makes mine management difficult as well as heavy taxation. Improvement of law and taxation should be connected with mining promotion. For improvement of taxation, some committees should be formed to concretely discuss the matter.

(1) Improvement of legal control

- Minimum and maximum area should be fixed in the exploration license
- Exploration license by a faster application system and simplification of procedure (application by submission of the desired area, plan, reason and target mineral for exploration)
- Permission for assignment of exploration license
- Ore reserve should be only reported to the related agency of the Government. Related agency compiles only the reported ore reserve, but does not need certification of the ore reserve. The Government's role concerning control of the ore reserve should make clear.
- Improvement of safety and technical regulation (by technical advance). Less national control and items to be advised
- Tax benefits (reduction of tax or tax rate) for strategic industry in Investment Law.
- Shortening of amortization term for machines and equipment
- Simplification of environmental procedure

(2) Tax system

- Tax reduction in the term of reconstruction for copper, molybdenum and gold that are strategic minerals in the Armenian mining industry (applicable for foreign investment more than US$ 20 million)

－exemption of VAT
－royalty of 1%
－exemption of customs duties for indispensable imported material for mining operation
－corporate tax 10%

- Tax reduction in the term of reconstruction for except above described minerals in the

Armenian mining industry (applicable for foreign investment more than US$ 20 million)

－VAT of 10%

－royalty of 1%

－exemption of customs duties for indispensable imported material for mining operation

－corporate tax 15%

- Special benefits for exploration investment of mining and exploration companies.

－exemption of VAT and customs duties for exploration equipment, machines and parts.

－exemption of customs duties for exploration equipment brought in by foreign companies

－deduction of corporate tax (according to the amount of exploration investment)

－exemption of corporate tax for purchasing stock of exploration companies

(3) Establishment of Committee of tax system improvement

- The committee is placed in the Prime Minister's Office collecting related ministries. A member of the committee consists of each ministry.
- National strategic industry will be decided. (with time limit, five years for example)
- Compliance between tax system and related law should be clear.
- Tax exemption or mitigation: corporate tax, royalty, VAT and custom duty
- Strategic industry must contribute to attainment of hard currency, employment and global economy.

5-3 System of Environmental Management

The administration side needs to install monitoring equipment for control and management of environmental protection by mining activity. From a long-term viewpoint, total digitalized IT control system should be aimed (Fig. 4-5-2). On the mining industry company side, there is insufficient system condition from superannuated and broken down equipment and facilities for environmental management

The system of environmental management is insufficient on arrangement for the administration side and mining industry company side and grasping the condition of environmental pollution. The countermeasures for environmental pollution by the mining activity before independence have not started yet. There is a possibility for becoming a hindering factor for the introduction of foreign capital.

(1) Environmental Monitoring Instrument and Installation of Facility of Countermeasure and Protection for Environmental Pollution

- Installation of monitoring instruments by administration side for regional monitoring points and production facility.
- Improvement and renewal for discharging facility by mining industry company side at each mine. Installation of treatment facility for stack gases on the smelting plant.
- Management of monitoring data by a sector of environmental management and its disclosure on a website. Stable organization should be settled by the introduction of a technical cooperation program of international agency.

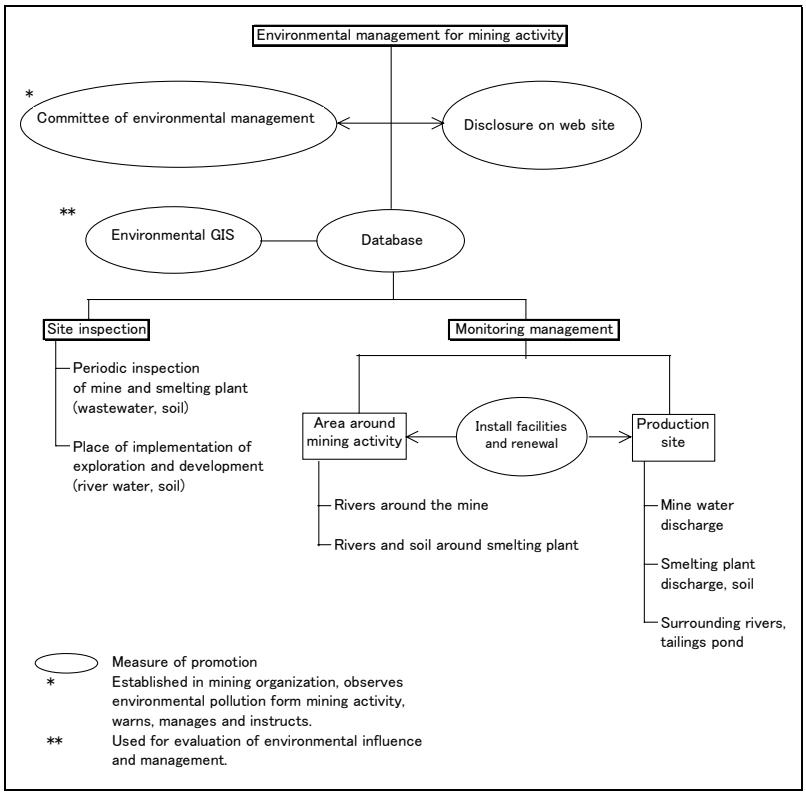


Fig. 4-5-2 Promotion Measure for Environmental Management

(2) Survey of the Present Situation of Environmental Pollution

- Survey of environmental pollution around the Alaverdi smelting plant. (Table 4-5-2)

Now the smelting plant does not grasp the present condition of the environmental pollution in the production activity of FSU time and does not take environmental countermeasures (treatment facility for stack gases, etc.) for the production of blister. It is needed to grasp the situation of pollution such as metal solute moving from slag stockpiles into the soil. Also it does not recover So_2 gas still now and this gas is released to the atmosphere as smoke from a high stack. The impact to the environment is unclear. Therefore it is needed to carry out a survey to grasp the real condition of pollution. Technical cooperation programs of international organizations or advanced countries are expected to be introduced.

- Survey on the present situation of heavy metal pollution in the southern area (Kajaran, Kapan, etc.). The situation related to pollution from the production activity during FSU time is hardly understood. It is indispensable to analyze the situation of the pollution for future privatizations. It is needed to concretely grasp the area of pollution and degree of pollution such as the impact to the downstream area and agricultural products. After survey and analysis of skills are attained by the Alaverdi smelting plant survey program, mine area should be surveyed by themselves.

(3) Establish trust fund of environment

Funding is necessary for the implementation of an environmental pollution survey and installation of environment monitoring equipment and facilities for environmental protection measures. However in the recent condition, it is difficult because of the condition of management of the mining industry and national deficit. It is needed to improve the

environmental management system by establishing a fund for the environment in the mining industry or usage of a mining fund (mentioned below). The source of the money is thought to be a loan from international organizations and each country. In case of the introduction of a loan, environmental protection measures are necessary by environmental survey.

- Establishment of an environmental trust fund. It is necessary to prepare environmental countermeasures after the mine is closed.
- It is needed to improve the present facilities and equipment by the mining fund (mentioned below).

Table 4-5-2 Survey Outline of Environmental Pollution conditions around the Alaverdi Area

1. Purpose
   - Solution for these conditions such as the degree and area of pollution caused by the production activity during the former USSR era.
   - Study of countermeasures and protection against the expansion of pollution by the solution for the pollution type and mechanism.
   - Improve the survey technology of a private environmental survey company of Armenia.
2. Content of survey
   - Survey are is 20 km x 20 km
   - Target of survey- (soil, underground and surface water)
   - Content of Survey
     - Content of heavy metals, chemicals, etc. in the soil around the smelting plant and agricultural areas (classification by the general and detailed surveys).
     - Content of heavy metals in the surface (well, river and pond) and underground water, pH, content of NOx, etc.
     - Condition of generation of dust, dross, slag, etc.
     - Hydrogeological structure
     - Impact of pollution to agricultural products and plants.
3. Funding for the survey (need to select one of the below options)
   a. Introduction of technical cooperation from international organizations or each country
   b. Implement own survey using the mining fund (order to the private sector by a government organization)
   c. Budget of a government organization (order to the private sector by a government organization)
4. Survey method
   - For the above case a, it is needed to introduce technology of equipment and method from a country, which possesses environmental survey technology.
   - For the above cases b and c, a request is made to send a technical expert from a country having this expertise (usage of technical cooperation).
5. Plan after the completion of the survey
   - Draft protection plan for the expanding pollution.
   - Implement protection countermeasures.
   - Implement environmental survey of the southern area.
   - Make environmental pollution map for the whole country over a long time period.

5-4 Privatization

Privatization of mining enterprises has advanced up to stage of corporate stock and a part of them was already sold to the foreign investors. Full-scale privatization is very important matter in near future. It is difficult at present for national investors to purchase the stock because they have not brought up enough to do it. At the same time, investment risk in privatization is large for foreign investors because there are a lot of problems to rebuild mining operation. Accordingly evaluation price for privatization may fall down considerably. Mining enterprises are desired to be reconstructed by Government funds so Government funds should be distributed reasonably according to priority rank. Improvement of management is needed by experts' assistance from international organization.

If internationally acceptable tender condition would be prepared, foreign mining companies with technology and funds might participate in the tender.

a. Tender Condition

- Reevaluation of property by the western standard (including ore reserve)
- Debt should be cleared off by the tender or drawn from its property.
- Government has responsibility of environmental contamination after the tender before a contract. (Detail responsibility should be clearly specified according to the actual situation based on environmental survey.)
- Fringe benefit is out of the tender so it is desired to be sold by the tender.
- Environmental equipment and facility will be prepared by new owners and their sum should be drawn from the property.
- Temporal tax benefit in VAT, royalty, corporate tax, custom duty and so on.
- Disclosure of financial report by IAS

b. Financial Improvement

- Obligation of IAS and its fixation
- Financial evaluation by supports from international organization
- Tax benefit and carrying over of debt for a long range
- Improvement of management by loans from EBRD in the same manner of ACP's loans from EBRD (A support of Government is necessary.)
- Instruction of foreign experts on strategic management

5-5 Exploration System

Promotion of exploration activity is linked to the efficient use of mineral resources and the promotion of the mining industry. The exploration system (subsidy and loan) should be established so that mining companies can realize independent exploration activity. Examination of establishing a mining fund is needed (Figure 4-5-3).

(1) Subsidy for exploration

• Regional Survey	Survey completely paid by funds of the government budget. The survey work is ordered to the private sector.
• General & Detailed Survey	Half subsidized
• Confirmation Exploration	Confirmation of ore reserves. Loan to the mining fund for exploration around the mine.

However for implementation of an exploration system, loan and subsidy, it is needed to establish an organization to examine the exploration plan, exploration budget, etc.

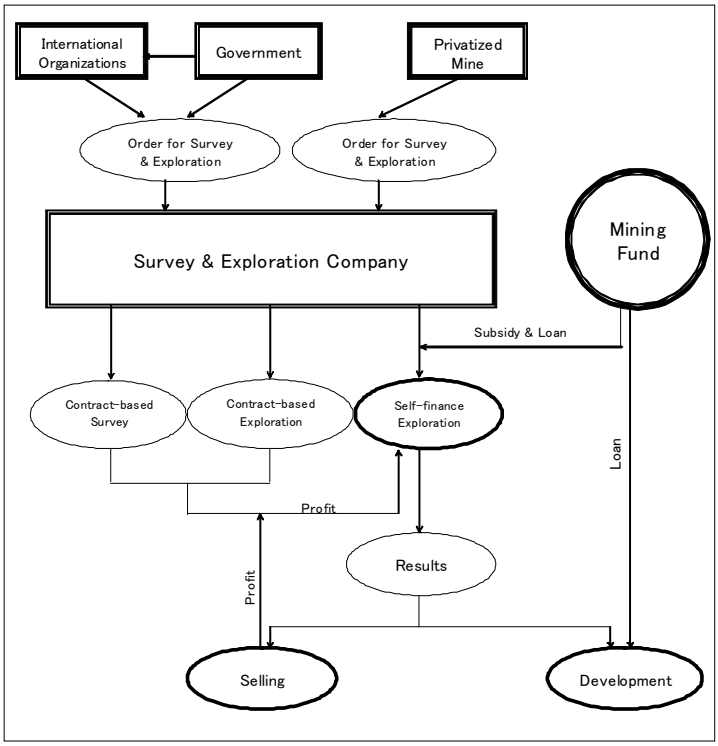


Fig. 4-5-3 Survey and Geological Exploration Companies Promotion Scheme

(2) Tax deduction for exploration investment by foreign capital

Tax deduction and reduction of tax rate corresponding to the investment amount for exploration activity by foreign capital is needed to be implemented for activation of exploration by foreign capital with a system having similar measures.

(3) Lease of exploration equipment

Superannuated and old exploration equipment is a hindering factor for the promotion of exploration. Exploration companies suffer from a money shortage, so it is needed to lease equipment to them. A lease company treats exploration equipment (drilling machines and geophysical equipment) and drifting machines (leg drills, transporting machines, generator, pumps and etc.) and is owned and managed by mining agent of Government. Lease condition is determined taking into account of economical situation of the mining companies.

(4) Plan for exploration and development

Maintenance, expansion or new construction of smelter is indispensable for reconstruction of continuous production system and promotion of Armenian mining. Accordingly above-mentioned exploration system should be planed and positive exploration development should be realized in the following target areas;

a. Copper Deposits

- Development of the Teghut deposit to support the Alaverdi Smelter
  - Introduction of SX-EW by leaching
  - Exploration of silicified rock bearing gold (1g/t) as flux in the smelter
  - Exploration by IP, electric-magnetic TDEM, drilling and etc. for reevaluation of the Dastakerd deposit (0.95%Cu, 0.0043%Mo)

b. Gold Deposit

- Priority is the holding deposits with more than 10 tons of gold
- The Marjian, Tuhmanuk, Lousajour, Verin Vardanadzor deposits

c. Exploration Plan

Necessary is balance of total concept between attained ore reserve by exploration, production of crude ore and feeding crude ore to the smelter. Exploration plan should be prepared on basis of wide consideration from exploring to smelting to give advices to private companies as a role of mining agent of Government (Fig.4-5-4).

(unit : tonns of Cu metal)

Dist.	mine	actual	year 1	2	3	4	5	6	7	8	9	10	remarks
Northern Area	Tekhut		drilling(oxidized zone)		leaching test		F/S	preparation,construction			16,000	20,000	crude ore: 5.0mill t/y with 0.47%Cu (rec.=85%)
	Alaverdi	1,000	1,500	1,500	1,800	1,800	2,500	2,500	2,500	2,500	2,500	2,500	crude ore: 70,000t/y→100,000t/y, 2.5-3.0%Cu (rec.=90%)
	Others		1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	Shamloukh,etc
	Sub-total	1,000	2,500	2,500	2,800	2,800	3,500	3,500	3,500	3,500	19,500	23,500	
Southern Area	Kajaran	12,000	12,000	12,000	13,000	13,000	14,000	14,000	15,000	15,000	16,000	16,000	Capacity crude ore: 9.2 mill t/y 0.27% Cu/y 18,000t metal Cu/y
	Agarak	4,000	5,000	5,000	6,000	6,000	7,000	7,000	8,000	8,000	9,000	9,000	Capacity crude ore : 3.2 mill t/y 0.34% Cu 12,000t metal Cu/y
			drilling 985m-895mL										
	Lichk		re-evaluation		preparation,construction			4,000	6,000	6,000	6,000	6,000	crude ore: 1.2mill t/y with 0.63%Cu (rec.=85%)
	Dastakerd		IP,TDEM	drilling	drifting			F/S	preparation,construction			10,000	crude ore: 2.0mill t/y with 0.95%Cu (rec.=85%)
	Marjian		regional survey		detailed survey			drifting		F/S	construction etc		
	Kapan	1,000	800	1,600	3,300	5,900	8,400	8,400	8,400	8,400	8,400	8,400	crude ore: Kazor :50,000t/y 1.44%Cu→500,000t/y 1.80%Cu Shaumyan:90,000t/y 0.30%→300,000t/y 0.34%
	Sub-total	17,000	17,800	18,600	22,300	24,900	29,400	33,400	37,400	37,400	39,400	49,400	
	total	18,000	20,300	21,100	25,100	27,700	32,900	36,900	40,900	40,900	58,900	72,900	
Others	silica (Alaverdi)		regional survey		drilling		estimation	preparation		5,000	10,000	13,000	1 mill t of potential resource partly 1 g/t-2g/t Au

Fig. 4-5-4 One Example of Copper Prospecting Program

5-6 Supporting Development

Privilege measures to the tax system and raising mining funds or supporting techniques are needed for the promotion of development of new deposits. It needs also to promote small- to intermediate-scale development with a small amount of investment by their own power by raising domestic capital although development depends on the introduction of foreign investment. (Appendix 4-7)

- Loan of development (examination of mining fund, guarantee for loan of funds of development, supply of interest)
- Support of development technology (technical cooperation of international organizations and each country)
- Introduction of economic evaluation technique
- Deferred payment of tax related to the investment for development. A decrease for the tax corresponds to the investment amount for development (VAT, excise tax and income tax)
- Model business of existing mines especially underground mines (introduction of technology

for strengthening competitiveness, etc.).

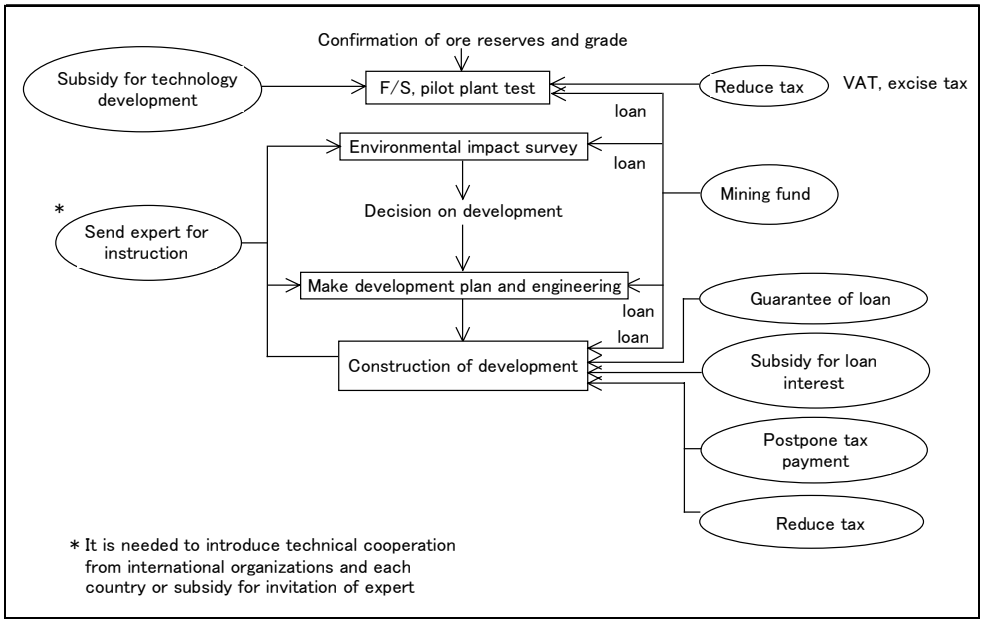


Fig 4-5-5 Promotion Measure for Development

5-7 Rationalization and Reconstruction of Mines and Smelter

Recovery of productivity is insufficient because of superannuated broken down facilities and outdated technology at each mine. However, privatization is partially promoted by the introduction of foreign capital. The measures for mines and smelting plants was concreted through examination and survey of Alaverdi smelting plant and mine (Kapan), which are the targets for this case study.

- Making a plan of rationalization for reconstruction.
- Technical introduction for production, technique (grade) and management at the Kapan mine (underground mine) of polymetal deposit. Introduction of management technology for production process. Simplification of organization.
- Loan of funds for the renewal of facilities and machines. A long-term loan from the mining fund, etc.
- Consulting for management, international accounting standards, quality control and energy conservation technology (technical cooperation using dispatch of experts from international organizations or advanced country of mining industry). Method of concrete cost reduction and knowledge and technology for grasping its efficiency.
- Separation or disposal of welfare facilities
- Sell or treat fixed asset excess.
- Reduce the electric power rate (privilege measure for a mining and smelting company in reconstruction stage giving one-third of recent electricity rate, reduction measure in the development stage is one-half of recent rate.
- Loan of funds for renewal of facilities and machines (examination of loan from mining fund, loan from international organizations, sell stock, etc.)
- Review of selling condition of products of the mining industry such as concentrate and blister, etc.
- Installation of environmental facilities and equipment.

- Privilege measure of tax system (no tax in a limited period for the renewal of facilities and machines in the reconstruction stage).
- Reduce manpower.
- Expand the scale of the Alaverdi smelting plant and install a production facility for electrolysis.

(1) Short-term improvement of mines (within 5 years)

Privatization of mines should be advanced in accordance with the present policy of the government in order to establish an operation system with a high profitability. At the same time, exploration work should be intensified to add more ore reserve for a long-term stable production. Capital gained by privatization of mines must be used effectively as financial resources for exploration. In case of exploration by private companies, government also takes into consideration of some aid fund.

Necessary operational points are discussed here in conformity to the present situation of the Armenia mining industry. Basically the operational improvements must be treated by private companies that may be mainly foreign. The main points in operational improvement of mine management are as follows:

a. Mining: the private companies should carry out.

1) Open Pit
   - Simplification of organization
   - Renovation of old machines
   - Optimization of machines size
     - If possible, scale-up of operation to increase production.
     - If necessary, scale-down to reinforce dilution control by shortening bench height
   - Establishment of operation center
     - Introduction of radio-transmitters to main machines
   - Improvement of principal working rate
   - Annexation of Departments Mining and Transportation
2) Underground Mining
   - Simplification of organization for high efficiency
   - Improvement of principal working rate
   - Reinforcement of dilution control → Selective blasting for waste or ore in mining
   - Renovation of old machines
   - Optimization of machines' size
     - Scale-up of operation to increase production
     - Introduction of trackless mining
   - Study on mining method for improvement of production efficiency and dilution → one example: Trackless cut and fill method

     However easy mechanization must be avoided because of expensive diesel machines, lack of maintenance know-how, underground ventilation problem, wide reformation of underground structure, and shortage of skilled workers for new machines

b. Mineral Processing: the private companies should carry out.

- Simplification of organization for high efficiency
- Promotion of equipment efficiency and labor saving → at first, renovation of decrepit equipment and machines is necessary.
- Stability of operation

- Improvement of recovery
- Grade-up of concentrate
- Study on full recovery of valuable minerals in crude ore
- Decrease of impurities in the concentrate to prevent penalty
- Study on recovery of valuable minerals from old tailings
- Establishment of laboratory for mineral processing test
- Review and modification of present operation flow → Simplification of circuits → Mineral research, mineral processing test (considering a favorable contract of concentrate sale)
- Maintenance and good administration of tailings dam
- Introduction of autogenous mill
- Introduction of column flotation
- Computerized control of operation in the long term

c. Administration department: the private companies should carry out.

- Simplification of organization for administration departments
- Some rationalization in administration department is necessary due to excess number of its workers.
- Balance should be maintained between "production" and "environment".
- Study on contract of concentrate sale to attain advantageous condition
- Exploration work should be intensified to attain more ore reserve. Some part of the fund gained by privatization of mines is used effectively for exploration. In case of exploration of private companies, government takes into consideration of some aid fund.
- Computers should be utilized for ore reserve calculation, material control accounting work to simplify and speed up work.

d. Supervision and Control Matters: the government should carry out.

After privatization of mines, operation system seeking after profit will be introduced by means of improvements mentioned above. The government should supervise each mine to carry on normal production, and it must give administrative advice when necessary. It is one idea for the government to prepare an agent that can supervise and control production activities of each private company. The agent consists of experienced engineers and functions under the ministry. Main points of supervision and control are as follows:

- Selective mining of only high-grade part without control
- Neglect of safety by emphasis on efficiency
- Neglect of environmental impact

(2) Medium term improvement of mines (from 5 to 10 years)

If Armenian main mines are privatized and attain continuous stable production, another policy for promotion of mining industry should be carried out.

- Attain ore reserve for next term mining by detailed and ascertained exploration
- Self exploration by private companies within their license area
- Promotion of exploration in the large probable area by initiative of the government (tax from privatized mines should be used for its fiscal resource)

5-8 Environmental Management of Mines and Smelter

Management of wastewater discharge, waste and tailings are insufficient. It is estimated that pollution of river water and soil by acid water and heavy metals are expanding around the mines. It

is needed to make supporting measures for environmental management to mines and smelting plants for strict protection by environmental standards for discharge and environmental standards.

- Installation of machines and facilities of environmental management
  - Monitoring of dewater, smoke and river water
  - Formulation of environmental control
  - Establishing administrative structure for monitoring data (mines, smelter and Government)
- Implementation and management system for inspection, maintenance and repair of facility for treatment of wastewater
  - Check on present facility and its repair
  - Periodical measurement of wastewater quality (once per month)
  - Control of data and countermeasures
- Disclosure of monitoring data. Disclosure of data by mining environment website.
  - First stage: Publication by mining web-site
  - Second stage: Settlement of mining environment web-site and publication of data

Financial fund for environmental control must be attained by mining industry itself, but it is now impossible to prepare environment equipment and facility due to shortage of money. It is supposed to establish mining funds and support the mines and smelter by loan from the funds or international organizations through Government.

5-9 Drafting the Settlement of the Strategy for the Business of Copper Smelting and Manufacturing

The present copper smelting business has managed by using the scrap of the Alaverdi smelting plant, which was broken in the USSR period, as the raw materials for a part of the concentrate in the domestic and copper scraps. The feasibility study for expanding production, electrolysis copper production and installation of environmental protection facility are needed. The copper business strategy should be settled by the examination of the advantages or disadvantages of the manufacturing business in the feasibility study. In the term of reconstruction, concentrate of the south area is exported to Iran in the same situation, and concentrate of the north area is better to be treated at the Alaverdi smelting plant by expanding the treatment capacity. Also, it is desirable to buy concentrate from Georgia and expand the amount of concentrate production by the promotion of exploration and development. In the term of development, it is thought to expand Alaverdi's capacity (40,000 to 50,000 ton per year) of electrolytic copper based on the feasibility study in the term of reconstruction (Fig 4-5-6, Table 4-5-3 and Fig.4-5-7). And the same time, it is necessary to study the oxide ore reserve by exploration and a possible introduction of SX-EW by field test.

- Implementation of the feasibility study for the smelting business (Study on ability to supply, sulfide acid market, market of concentrate and metal using existing facilities, condition of location, etc. is important).
- Implementation of pre-feasibility study for copper manufacturing (market of manufacturing products, technology, etc).

It is better to study the establishment of an industrial park (tax-free zone) for the copper manufacturing business based on the cooperation with Iran. Intensive production for copper manufactured products is efficient for strengthening its competitiveness (Fig. 4-5-9).

- Study on introduction of SX-EW method

Feasibility study or pre-feasibility is indispensable in strategic action for copper smelting and manufacturing industry, but its business scale depends on treatment and domestic/neighboring market of sulfide acid for the reason of environmental protection. Usage of sulfide acid in Armenia

is supposed in fertilizer, additives to asphalt for road paving and solution of SX-EW. Not only feasibility study within copper smelting and manufacturing industry but also feasibility study on total copper industry taking into account of environmental countermeasures, environment protection, promotion of agriculture, road pavement and development of SX-EW, would give a clear orientation and scale of copper business. Accordingly it is possible to attain fatal conclusions for following problems; 1) Repair or expansion of the Alaverdi Smelter, 2) Construction of copper smelter in the southern area, 3) Study on necessity of two smelters, 4) Current situation and sale of concentrate to foreign countries like Iran. In case of selections related to environmental protection and countermeasures, maintenance of infrastructure or fertilizer, it is easy to attain international supports. As mentioned above, total feasibility study is necessary to determine the maximum effect of copper industry (Fig. 4-5-9 and Table 4-5-4).

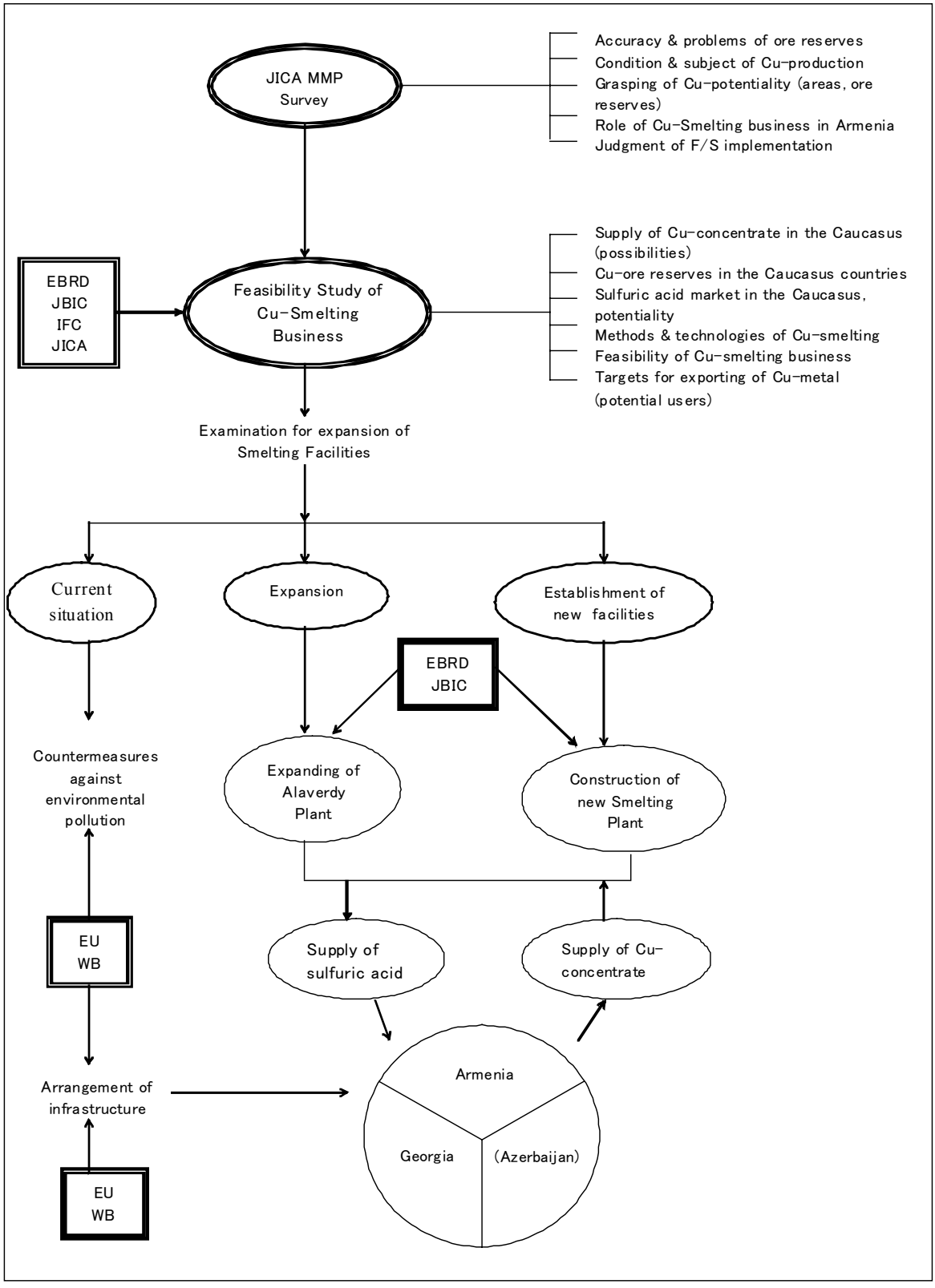


Fig. 4-5-6 Improvement Scheme of Copper Smelting Business

Table 4-5-3 Draft Plan of Copper Business Concept

Area	Reconstruction term	Development term
North area	• Reconstruction of Alaverdi (Cu metal basis 30,000 tons) • F/S for Alaverdi expansion of electrolytic refining • Promotion of exploration and development • Buy concentrate from Georgia (10,000 ton Cu)	• Alaverdi expansion and construction of electrolytic copper refinery (40-50 tons Cu) • Copper production increased by new mine (20,000 tons Cu) • Promotion of exploration and development
South area	• Promotion of privatization and reconstruction of mine • Continue exporting to Iran • Concentrate production increased from existing mines • Promotion of exploration and development	• Increase concentrate amount (30,000 to 40,000 tons Cu) • New mine development • Promotion of exploration and development
Whole country	• F/S of copper business • Study of industrial park of copper manufacturing with Iran • Evaluation of establishing a new smelting plant • Confirmation of sulfuric acid market • Confirmation of copper oxide ore reserves, test for SX-EW • Raise domestic trading company	• F/S and determination on industrial park establishment • Selling sulfuric acid to Caucasus area • Decision on new smelting plant • Trading business started by domestic trading company • F/S for SX-EW

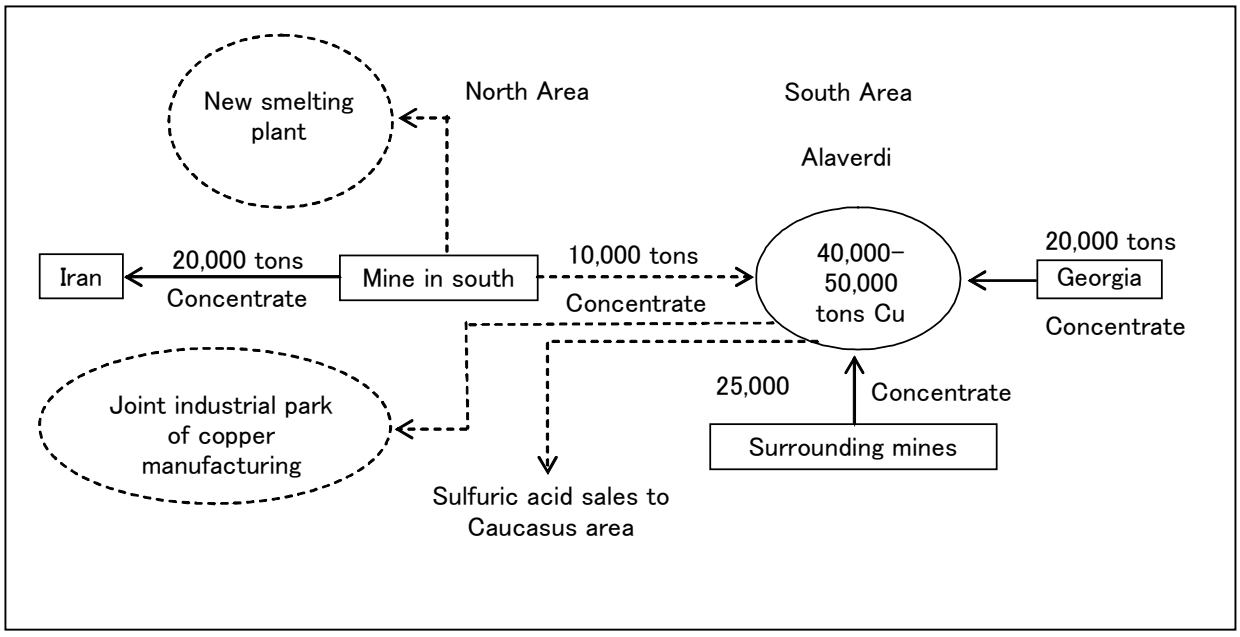


Fig. 4-5-7 Draft Plan of Copper Business Concept after 10 years

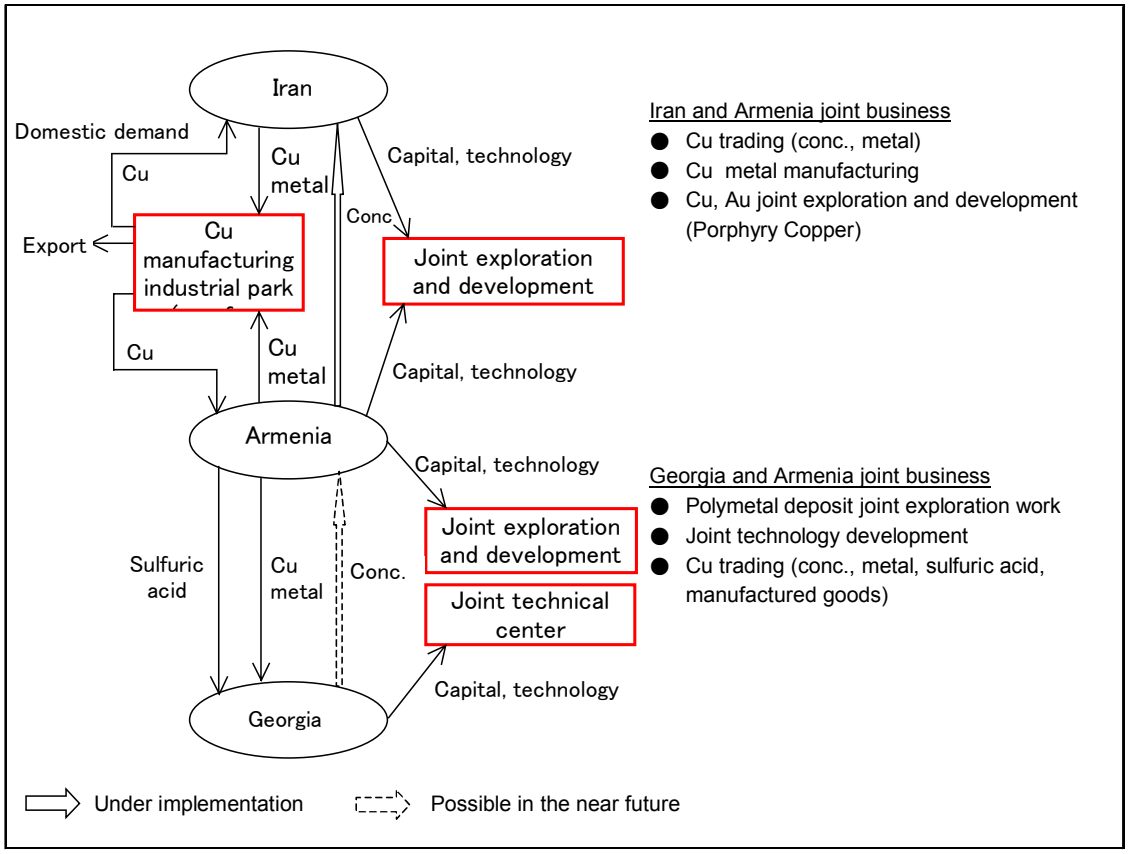
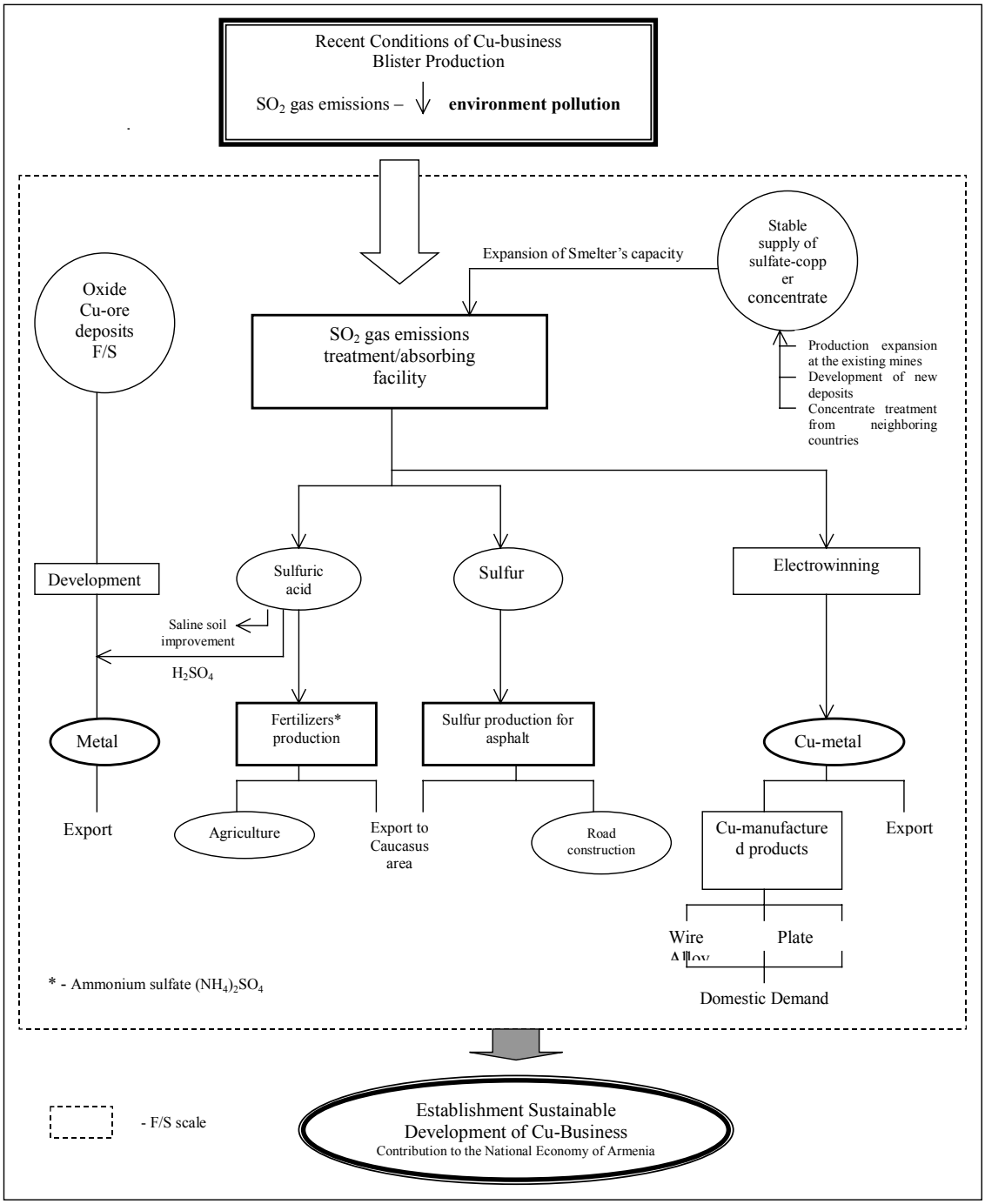


Fig. 4-5-8 Promotion Measures of Joint Business with Neighboring Countries



Concept of Cu-Business – Basement of Armenian Economy

Fig. 4-5-9 Copper Business Concept

Table 4-5-4 Necessity of Comprehensive Feasibility Study on the Copper Business

1. Results of Mining Master Plan (MMP) investigations
   - Cu-business has an important role in promotion of mining industry of Armenia
   - Armenia has a potential for Cu-concentrate supply to the Smelters (over 40 thousand t/y)
   - Yet there is no demand and market for sulfuric acid inside Armenia, therefore it is needed to create one.
   - There are possibilities for introduction and use of SX-EW technology. However surveys of oxide ore are insufficient.
   - Copper Smelter doesn't have necessary facilities for environment protection and it pollutes surrounding area. It is needed to install environment protection facilities.

2. Necessity and purpose of feasibility study:
   - To study necessity of investment and feasibility for environment friendly Cu-business based on MMP survey results
   - To judge suitable business system and feasibility
   - To concrete the governmental policy and the course of copper business development

3. Study items:
   - Production of Cu-concentrate (potential of Cu-concentrate supply domestically and Caucasus Area)
   - Evaluation of oxide ore reserves in order to organize copper production based on SX-EW technology, feasibility study of target for development deposits (Teghout etc.)
   - Market for sulfuric acid and sulfur in the Caucasus area
   - Potential market for fertilizers produced from sulfuric acid domestically and in Caucasus area
   - Improvement of soil polluted with salt
   - Potential market for sulfur from Smelter domestically and in Caucasus area in the field of asphalt production necessary for road constructions
   - Consumer markets and potential market for Cu-metal manufactured in Caucasus area.
   - Potential clients and users of Cu-metal for export.

4. Term of study and supporting organizations
   - Two-years
   - As nominee organizations for feasibility study implementation the following organizations (EU, EBRD, IFC, UNDP, JICA) are thought to be appropriate

5. Output
   - Policy of Cu-business and business design
   - Mitigation of environment pollution from Smelting Plant
   - Judgment of copper production by SW-EX and feasibility of target project for development (Teghout etc.)
   - Suitable size, amount of investments, technology, facility and feasibility of Cu-smelting business in Armenia
   - Judgment of possibility for establishment of fertilizers production plant in Armenia
   - Suitable size of the Alaverdy Cu-Smelter in the Northern area of Armenia
   - Judgment of consideration of construction of new smelter in the Southern part of Armenia
   - Judgment of Cu-metal manufacturing business from the point of view of an appropriate size, site, kinds of products and technology
   - Comprehensive feasibility study of Cu-business for sustainable development
   - Method of raising the funds necessary for investments

5-10 Disclosure of Information

Disclosure of information by a website is the first step for the investor. Information of exploration related to geology and mineralogy of the deposit in the second step is an insufficient arrangement. Existing data and documents are in a report of each survey. Most data and documents are in Russia. Therefore, it is a hindering factor to access the information. It needs the arrangement of information by digitizing and reference systemization such as data and documents. However, the disclosure of the information in the second stage is thought to be examined as a target for a confidential agreement or partial fee basis. It is desirable to have access to a website with comprehensive information on mineral resources in addition to mineral resource information regarding non-metal and energy in the first step of the website. Also, if a system of retrieval is established on the website, it will be used more efficiently (Fig. 4-5-10).

Geological map at 1:50,000 is basic and important as resources information. It covers 80% of all territory and perfect in the mineral areas. But at present there is only one hand made geological map that is nondisclosure so it should be digitalized and open in charge.

Procedure of mine concession is not systematic yet. Application, technical drawing like geological deposits, exploration and excavation plan should be normalized and regulated by introduction of GIS system.

- Establish retrieval system on the website.
- Construction of reference system by digitizing the resource information.
- Construction of maintenance and management, and addition of data.

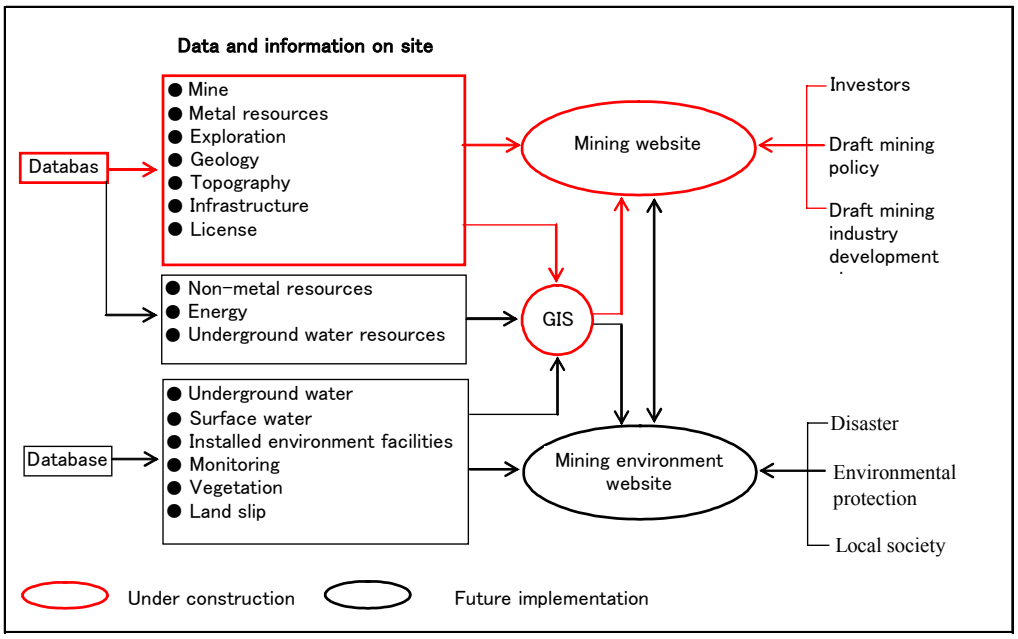


Fig. 4-5-10 Promotion Measures for Website and GIS

5-11 Mining Fund

Raising funds is the largest subject for realizing the promotion measure of the mining industry. Insufficient State budget, large debt and chronic financial deficit make it difficult for expenditure for the promotion measure. It is expected to realize a part of the support measure by establishing a mining fund, which is funded as a part of the original capital by the funds of royalty, etc. Also it is needed to realize a loan for the fund by an international organization. However,

expenditure from the fund and method of management is an important subject. (Fig. 4-5-11)

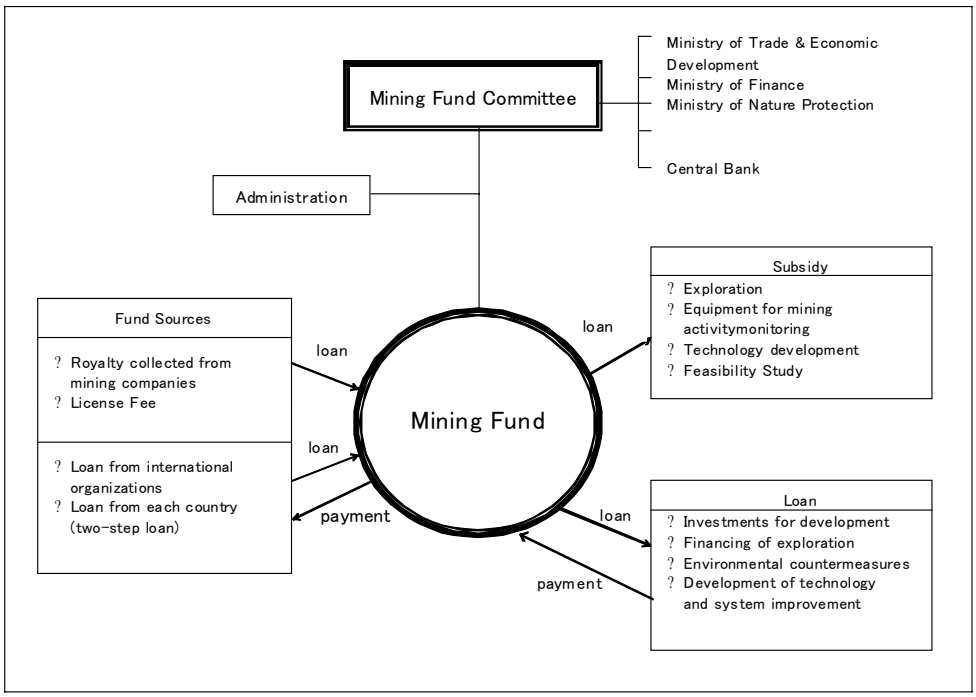


Fig. 4-5-11 Mining Fund (basic idea)

- Fund raising method
  The source money is sought such as budget of the government, royalties of mining industry companies, national bonds of intermediate term, etc. However, if there is no introduction of a loan like the two-step loan by international organizations (Government becomes a borrower to loan to private companies.), the fund will be small scale and its effect on the promotion of the mining industry will be small. It is needed to make a feasibility study for a loan and concrete study for the management of the fund. Royalty or two-step loan from international organizations can be funds as a practical raising method, because it is difficult to attain it by the Government budget or issuing bonds under current economic situation.
  - Royalty
  - State budget
  - National bonds of intermediate term
  - Two-step loan from international organization
  - Repayment after loan
- Target of subsidy and loan of the fund
  It is needed to define a target for a loan and a target for a subsidy. The area for a target is limited by the scale of the fund.
  - Subsidy system for exploration
  - Loans to promotion system for development (feasibility study, engineering and construction works for development)
  - Loans system for reconstruction or rationalization
  - Subsidy for technical development
  - Subsidy and loans for pollution protection

- Operations and management

  Organization and method of management of the fund is important for the maintenance and promotion of the fund. It is needed to make an organization like the committee of fund management.

  - Legalization of system (loan and discount, conditions for subsidy, sum)
  - Funds operation committee
  - Methods for funds administration and callback and shift conversion

  However success example in funds operation is very rare. Funds raising and its administration are not easy so deep consideration is necessary.

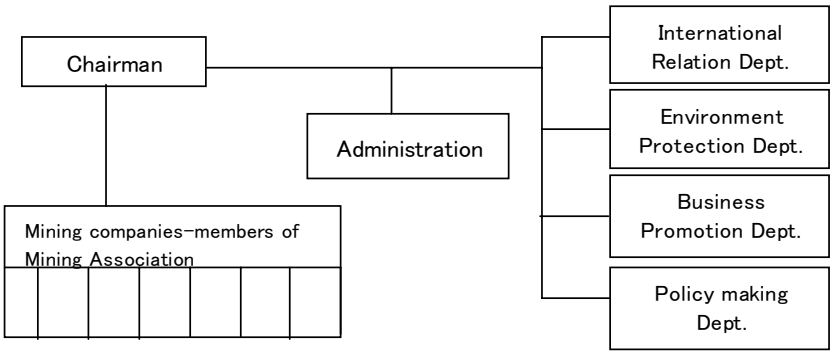
5-12 Association of the Mining Industry

The sound development of the mining industry is the harmony between the administration and the private sector. Establishment of a mining industry association is needed for a role as a mediator between the administration, mine and local residents, as a group for receiving requests from the private sector and bringing them to the administration, and as a communication organization for requests from the administration to the private sector. The association is composed of mining, smelting, and survey companies, consultants, and foreign capital companies. The association also has a role for gathering information on the mining industries in the world (Fig. 4-5-12).

At present private mining activities are not so brisk. It is necessary to settle Association of the Mining Industry that leads mining activities from viewpoint to make private mining companies independent rapidly and promote mining industry. There is currently Underground Resources Union which will be a group member of the Association but it has not sufficient capacity for above mentioned activities. The association should be managed by same way as advanced countries. And the same time, excellent human resources with English ability and sufficient mining knowledge are necessary under the globalized mining industry to attain objectives, content and action method of the Association.

- Establishment of a mining industry association has a role of communication and adjusting requests of private companies.
- Establishment by funds of NGOs from the USA and other countries.
- Website is needed to be established. The website is linked to the mining website.
- Instruction by experts from advanced countries in mining. Distribution of human resources with English ability and mining knowledge.
- Compile information on private sector in mining activity.

1. Purpose
    - Organization of group of mining companies for promotion of mining industry
    - Realization of promotion of sound mining sector activity
2. Satisfaction
    - NGO Registration in Ministry of Justice
3. Member
    - Armenian Mining, Exploration, Survey, Consulting & Engineering Companies
    - Foreign Mining, Exploration, Survey, Consulting & Engineering Companies (working in Armenia)
4. Organization



5. Role
    - Mining policy proposals to governmental organizations
    - Information exchange with government
    - Gathering of information concerning trends and status of mining industry in the world
    - Compiling of activity for mining companies
    - Adjustment with local society – environment protection etc.
    - Holding of seminars
    - Information disclosure through web–site
6. Activity funding sources
    - Membership fee from mining companies, acquire of financing from international foundations

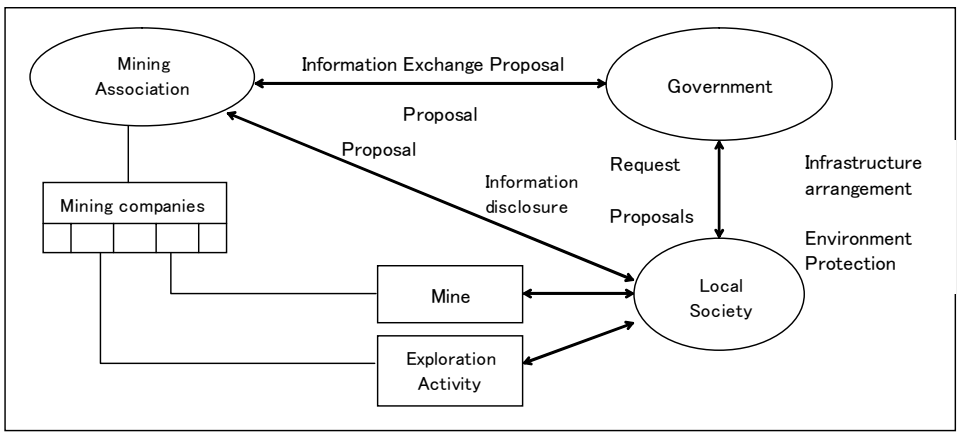


Fig. 4-5 12 Concept of Mining Association

5-13 Education of Human Resources

At the present time, the activity of the mining industry is in stagnation compared to FSU time. The education basement, which was in FSU time, has become weak. The neighboring country of Georgia is in the same situation. It is desirable to establish a technical development center for training its manpower by reforming and improving its mining industry technology, which has comprehensive knowledge, based on cooperation with Georgia. Also, it is needed to develop its manpower by inviting instructors from advanced mining countries for training its manpower in advanced mining countries. Establishment of training system by Armenian Government and usage of a human resources training program of international organizations and each country should be studied.

Armenian level in education and knowledge is high. According to expansion of globalization, information technology, efficiency, internationalization and systemization are essential to join to the single market that is under construction. From demand of competency, development of appropriate human resources is indispensable for each organization, agencies, companies and others under market-oriented economy. Armenia must intensify education of English, an international language, for mining related people to catch up to the international market because of its small population. At present foreign investment is actually important but in future it will be necessary to build a national mining industry to contribute Armenian economy in order to avoid a loss of national profit by dependence of foreign investment.

a. Establishment of a technical development center

Geological condition is same as Georgia so type of ore deposits is also same. A technical development to enable system and technical development is needed jointly with Georgia. The center is desired to have a common theme target of Georgia (Fig. 4-5-13).

- Improvement of mineral processing technology for complicated ore.
- Development of a new system for underground mining
- Introduction and improvement of SX-EW method

The roll of this center should not be development of basic technology but practical and adaptable fighting potential technology.

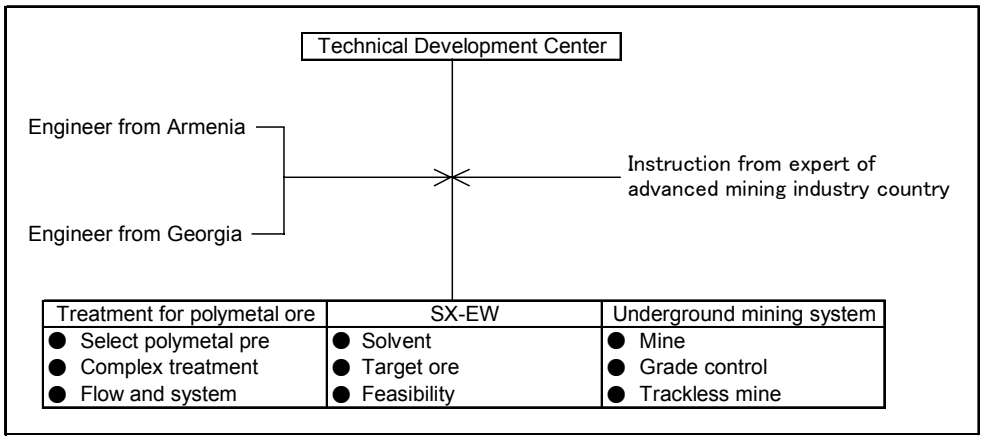


Fig. 4-5-13 Technical Development Center

b. Training system in advanced countries in mining

- Establishment of training system by Armenian Government (national budget)
  - Engineers of private companies
  - Mining sector staff of Government
- Usage of training programs of international organization or advanced countries

- Education of executive trainees in Government to be internationally minded
- Education of young people in private mining companies

c. Invitation of experts

International situation and international accounting and other current information are collected from top experts from the mining industry in the world.

- Information in specific fields (mineral economy, environment economy, mineral evaluation, feasibility study)
- Mining situation (the newest technology, M&A of mining companies, environment problem/ countermeasures, mining policy)
- Mining finance, mining accounting (funds raising, international accounting)
- Management of mining company (management system, investment condition & its evaluation, raising of capital)

d. Domestic training system

To develop mining engineers, mining management and staff, executive officers of the Government, establishment of domestic training system is important for Armenian mining industry which has problems of depopulation and generation change. If this training combines with b. and c. mentioned above, its effect is much higher (Table 4-5-5).

- Basic education for English, accounting, legal system and so on
- Mining specific education like mining policy, mining promotion plan, environment protection and so on
- Practical mining education like management, environment control, business accounting

Table 4-5-5 Domestic Training Program

Category for Training	Program	Target
Basic education	English, accounting, law and tax system, general knowledge, business manner	• Young staff related to mining industry • Each government organization is responsible
Specialized field	English, mining policy, mining promotion measures, environmental protection, economic policy, macro-economy	• High-ranking government officials • CEO of company
Practical education	Management strategy, environmental management, corporate accounting, International accounting standards, making a budget	• CEO, directors of company • Each government organization's high-ranking officials

5-14 Promotion Measures with Neighboring Countries

Armenia is a landlocked country. Therefore, it is needed to construct cooperation with neighboring countries on the mining business especially the activity of exploration, research, technology development, education, smelting business, manufacturing business, etc. for bringing efficiency in the mining industry. This is an important subject for examination (Fig. 4-5-8)

- Exploration with cooperation of Georgia for polymetallic deposits in the north area. Joint exploration with Iran for porphyry copper deposits in the south area.
- Cooperation facility with Georgia for education, research and technology development center.
- New division system for the Caucasus area in a free economy.
  - Copper smelting in Iran for copper concentrate in the south area
  - Establishment of joint cooperation industrial park for copper manufacturing (tax-free zone by Iran and Armenia). Incentive is given for production and downstream production.
  - Copper smelting at Alaverdi for concentrate from Georgia.

5-15 Resources Information Center

Ten years has passed since Armenia was independent. However it is not capable to attain the global mining tendency but only the partial information. It is necessary to grasp the exact global tendency for promotion of the Armenian mining industry. If there is a function to transmit information of the Armenian mining industry to the world by means of internet system, it will be of assistance to promote mining investment by foreign investors. Establishment of this kind organization would be able to carry out the appropriate mining policy and promotion plan (Fig. 4-5-14).

- Collection of information like metal price, exploration, technical development, companies activities (mainly from internet)
- Collection and compilation of mining laws, mining policies and tax information in other countries
- Transmission of the world mining information to domestic demanders through website.
- Distribution or sale of the Armenian mining information (resources map, geological map and etc.)

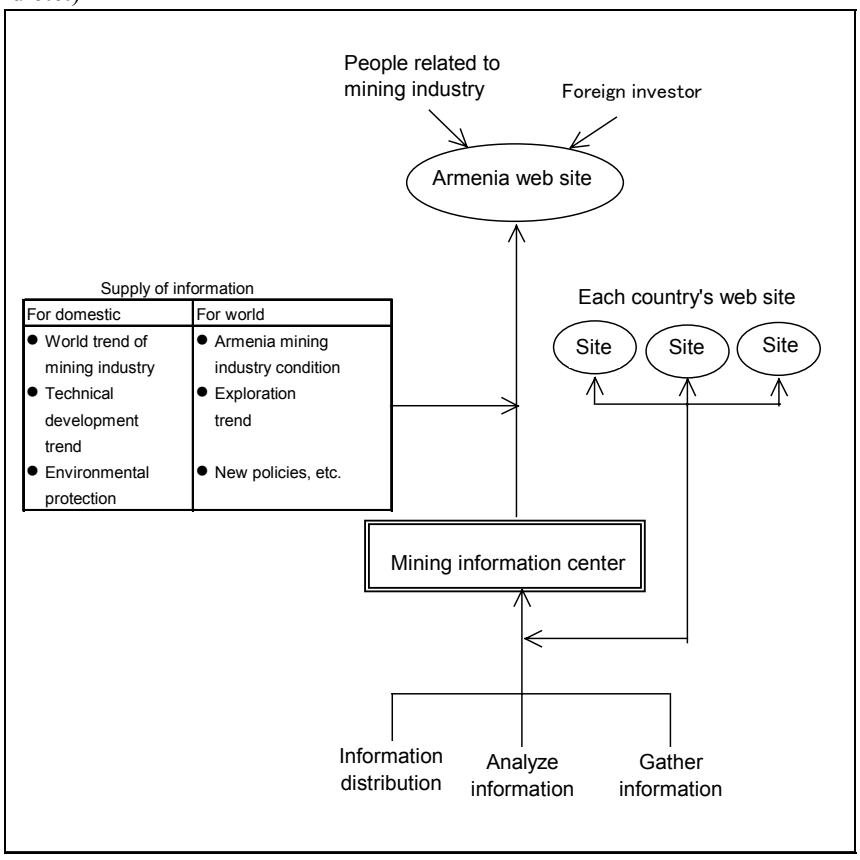


Fig. 4-5-14 Resources Information Center

6. Subject to Realize Settlement of the Promotion Measures

6-1 Mining Promotion Plan

The Armenia mining industry is linked to contribute to the growth of the economy, State finance and international balance of payments by realizing the promotion measure of the mining industry. However, the national budget has a deficit structure and financial market is immature. It is difficult to raise money for realizing the promotion measures in the circumstances of restructuring because many mining companies are in stagnation. At first, the promotion measure should be

realized by their power. It is needed to study from the viewpoints of the budget, tax system and law for the realization of the promotion measure. Investment condition, which is attractive to foreign capital, should be made. Armenia must have law, tax system, investment risk that is competitive compared to other countries for investment. The realization of the promotion measure by the present State budget, arrangement of investment, support from international organizations and each country are important. Therefore, the mining industry should be positioned as a state priority industry. It is important to realize and create a project combining promotion measures as an international organization project. Also, it is indispensable for a method to raise funds. The company having domestic capital gradually increases its strength through joint venture with foreign investor by the introduction of foreign capital and ordering of survey work to domestic mining industry company by government organizations.

- Improvement and arrangement of mining law quickly, review tax system
- Raising funds to construct a mine and smelting plant.
- Examination of possibility for the promotion of exploration and development and mining fund.
- Recognition of the mining industry as a priority industry.
- Support from international organizations or each country (creation of project based on promotion measure)
- Forming financial market

6-2 Investment Scale to Promotion Measures

A huge finance is needed for the promotion of the mining industry by realizing promotion measures. Investment scale in the implementation term of the Master Plan is US$100 million for the reconstruction term, US$200 million for the development term for a total of US$300 million, on a very rough estimation (Table 4-6-1). These money should be financed by loans and technical assistance from international organizations and each country, foreign capital, Armenia government (tax revenues, national bonds) and domestic capital. Concrete effective investment of the investment amount and term of repayment of the loan are needed to study the target of investment. Also, the method of finance after drafting a plan of investment should be concreted.

Table 4-6-1 Goals of Investment for Promotion Measures

(1) Reconstruction Term

	Amount (US$ million)	Promotion Measures
National Budget	15	Management improvement of state enterprises based on copper business F/S, arrangement of tax and law, information arrangement, evaluation of resources, support for exploration and development
Foreign Capital	45	Mine management improvement of Kapan and Kajaran mines, environmental countermeasures, exploration, development of new deposits
Domestic Capital	20	Exploration, development, copper smelting plant expansion, equipment of environmental management, reconstruction of mines
International Organizations	20	Environmental survey, improvement of management, countermeasures for environment, monitoring system of mining industry company, arrangement of IT, change to IT
Total	100	

(2) Development Term

	Amount (US$ million)	Promotion Measures
National Budget	20	Support for exploration and development component F/S, engineering of business project based on copper F/S construction of environmental countermeasures,
Foreign Capital	80	Exploration and development (copper, gold)
Domestic Capital	40	Exploration and development
International Organizations	60	Construct environmental countermeasures, expand IT, environmental facilities of copper smelting plant
Total	200	

6-3 Assistance Program and Promotion Measure

International organizations (WB, EBRD) and each country like Japan (JICA, JBIC), etc. have assistance and supporting programs for various fields. It is better to study the introduction to the project (promotion measure) to be possible that applies to a program in these programs on the promotion measures. The realization of the introduction should be attempted by the concretion of promotion measures on the study of these measures. Mining organizations should make an effort for the introduction by survey of the assistance program of each country, international organizations, and by studying the possibility for realizing the promotion measure of the assistance program. EU-PHARE is a fund for the reconstruction of East Europe. The Armenia government is now requesting as a target country for using this fund. If Armenia is recognized as a target country for this fund, EU-PHARE will become a powerful assistance fund for the mining industry promotion. EU and World Bank have implemented already support for an environment project with the target of three countries of the Caucasus. The creation of an assistance project for the three countries of the Caucasus in the mining field and realization of these supporting projects from international organizations are the subject for studying now on.

CHAPTER 5 RECOMMENDATIONS

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1. Importance of the Mining Industry

1-1 Mining Industry's Effectiveness to Other Industries

Japan was once a mining industry country. Profits from the mining industry created and expanded the machine and metal manufacturing industries. The mining industry has constructed the basement of industries. Recently, Japan has become a mining industry country having the smelting business as its main constituent with dependence of importing almost all the concentrates such as copper and zinc because of the reduction of mines. Japan is a custom smelter with a 10% share of copper smelting and 8% share of zinc smelting in the world. However, the metal industry, machine parts industry and electronics industry have been expanding with the mining industry as the basement of them.

The mining industry has effectiveness for developing and extending to the downstream businesses and application business by using metal like smelting → metal manufacturing → parts, electronics industries, if the mining industry is competitive by the effective practical use of its underground resources. Also the development of mines linked to the arrangement of the local infrastructure and promotion to the distribution business (Fig. 5-1-1).

Armenia has comprehensive technology from exploration, development to smelting for copper, molybdenum and gold. Armenia has potential underground resources linked to the production of 50,000 tons per year copper, 20,000 tons per year zinc and 5 tons per year gold as a metal basis. Therefore the establishment of a mining industry basement with competitiveness is needed to be done by the arrangement and reconstruction of existing mines and smelting plants, promotion of exploration and development such as copper, zinc and gold, at first, under a free market economy. Armenia should recognize the role of the mining industry for economic growth and position the mining industry as a strategic industry for the above reasons. Therefore Armenia should concentrate their power and tackle to realize the Master Plan.

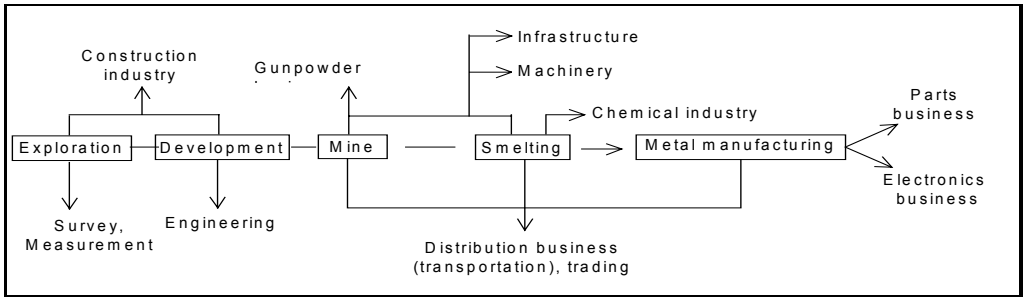

Fig. 5-1-1 Extending Business from Mining Industry

1-2 Trend of Metal Production Amount

Metal production amount in the world has been growing at 1-5% for many metals. Main metals show a positive growth in 1990-2000 (Fig. 5-1-2). Recently recycling has been promoted. However the rate of recycling is low (copper 13%, zinc 4%). The condition of dependence to metals from underground resources has not changed in the world.

Armenia's reserves (metal amount) are copper 7.7 million tons, zinc 890,000 tons, gold 390 tons and molybdenum 860,000 tons, etc. Armenia's reserves can contribute at the above rates to the world's metals production growth. Armenia's reserves are needed to promote their usage based on the metals' growth rate in the world and rate of recycling. The mining industry is based on supply and demand. The metal mining industry is an industry for acquiring foreign currency by production of international products. Armenia has a chance for obtaining a market of its mining

industry products in the expanding markets. Expanding of production by recovering at the early stage is needed based on the Master Plan and recognition of the importance of the mining industry.

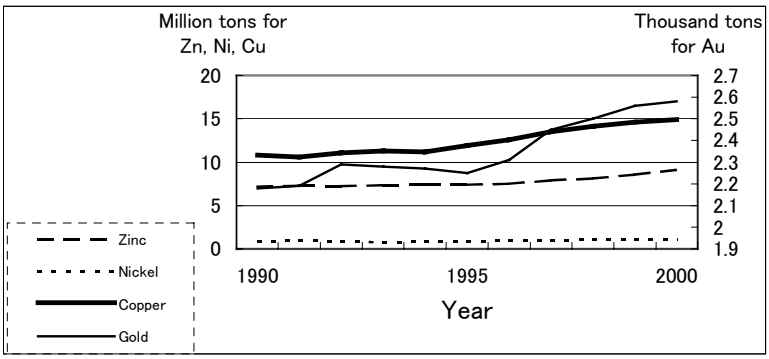

Fig. 5-1-2 Trend of Metal Production in the World Source: USGS Mineral Yearbook 2001

1-3 Reconstruction of the Mining Industry Basement

The mining industry basement is composed of technology, training of human resources, infrastructure and facilities, laws and regulations, management and operations, protection of the environment, and changing to IT, etc. In the FSU (former Soviet Union), these basements have been maintained in the Soviet distribution system. After independence, reconstruction has been done for adapting to a free economy system for making the transition to a free economy. Laws and regulations have been arranged. However, the renewal of technology, acquiring knowledge and know-how on management and operations, and change to IT has now started. Training, which gives importance on the mining field because of the recession of the mining industry, is a future important subject. Mining industry facilities need investment for superannuated equipment and renewal of equipment and facilities for environmental protection is indispensable now and in the stage of practical implementation

Table 5-1-1 Reconstruction of the Mining Industry Basement

Main Arrangement of Basement Items	Method of Reconstruction	Content
Technology	• Introduction of foreign capital • Improve existing technology	• Technical transfer of foreign company • Instruction of expert from advanced country of mining industry
Infrastructure	• Support from international organizations	• Repair roads, arrangement of railroads
Facilities of mining industry	• Privatization (introduction of foreign capital)	• Renewal by investment of foreign company
Human resources	• Introduction of foreign capital • System of training • International organization support	• Acquire knowledge, technology from foreign company • General training and specific field training • Spread of international accounting standards
Information technology (IT)	• Expand web site • Introduction of foreign capital	• Introduction of equipment from foreign company • Digitize information and data
Protection of environment	• Privatization • International organization support	• Facility and equipment renewal • System of monitoring in mining industry district

. Arrangement of basic infrastructure has been started by the support of the World Bank and each country, etc. The reconstruction of the basement needs a huge amount of investment, is not easy and takes a long time. However, if the reconstruction is done by the participation of foreign investment on the privatization, introduction of foreign investment for exploration and

development, support from international organizations and sending experts from advanced mining industry countries, etc., the mining industry basement will be arranged. For this matter, people who have a view of the whole mining industry are needed and should promote the reconstruction of the mining industry basement by checking on the condition of its arrangement with the establishment of a unified organization of the mining industry (Table 5-1-1).

2. Expanding Future Potential of Copper Mining Industry

The characteristic of the Armenia mining industry is copper deposits. Gold, molybdenum and zinc exist in many kinds of copper deposits and composed of copper- molybdenum deposits, copper-gold deposits and copper-gold-zinc deposits. Now these types of deposits were developed and operated as mines. Also Armenia has a copper smelting plant and part of the molybdenum concentrate is treated in the smelting business. Copper is positioned as a basic business in the mining industry.

If the production system was constructed for the production of electronic copper like before independence in the copper smelting business, the production of rolled copper products like pipes, plates, sticks and wire from copper metal becomes a possibility. Also, copper metal and these products are linked to the expansion of the alloy business or parts manufacturing business by using copper. The market is the Caucasus area and neighboring countries. The copper smelting business brings the manufacturing business related to many kinds of copper products and the creation of the parts business. There is potential for expanding employment.

Almost all the copper mineral in Armenia is chalcopyrite. Sulfide acid, which is produced for environmental protection in the smelting business, contributes to the promotion of agriculture as fertilizer. Sulfide acid also has a possibility for restoring land as a neutralizing material for salt-damaged land. Moreover, it is possible to adapt to treat copper oxide ore by SX-EW method and it is not impossible to develop a new mining industry balanced with the environment like in-place leaching. Sulfur has a potential possibility for use as a material for solid and heat resistance for asphalt roads. If it is possible, sulfur can become the material for asphalt and effective reduction of the use of heavy oil. This will bring about cost reduction. The market for sulfur will expand over the whole Caucasus area.

Therefore the copper mining industry has a big effect of expanding to develop agriculture, new mining industry and industry. The government should recognize sufficiently the importance of the copper mining industry and position it as a national strategic industry. Therefore, a feasibility study that grasps the economics of the whole copper mining industry should be implemented.

- The copper mining industry has the highest priority strategic business of the nation.
- The copper mining industry has a possibility for the development of downstream business such as manufacturing industry and copper parts business.
- Protection of the environment for the copper smelting business has the potential to create a new leaching mining industry and promotion of agriculture and industry.
- A feasibility study is needed to grasp the comprehensive business feasibility of the whole copper mining industry.

3. Training of Human Resources

3-1 Government Organizations

System of training human resources is recommended in this Master Plan. It is not desirable to reconstruct and promote the mining industry for improvement of the mining industry in its recent condition, if the government organizations do not recognize the importance of the Master

Plan and does not tackle its realization by the concentration of their power. It is indispensable that the private and government sectors become like one body. However, now the private sector activity is insufficient in its recent condition. Therefore if the government does not promote aggressively, the activity of the private sector will not be activated. For the above matter, the generation change in human resources related to the mining industry should be a priority issue.

To acquire the abilities to abilities to make a plan, establish a vision, and administrate are indispensable for the training of the new generation having a role in the mining industry sector in government organizations. Personnel who can grasp the comprehensive mining industry are needed to train and to be raised. Now English has become the common language around the world. The mining industry is a business that is developed internationally. Bureaucrats and technocrats in charge of the mining sector in government organizations are required to acquire the above abilities and language ability through training education, training system, human resources and overseas training from now.

A 5-year action program for the term of reconstruction in the Master Plan is proposed. For implementation of measures in the action program are needed to make an intermediate-term plan (5 years), short-term plan of 1-2 years based on the intermediate-term plan, make a budget for the implementation of measures and implement the budget. Moreover, it is needed to request support from international organizations for the above abilities. Therefore the necessity of the promotion measures and effectiveness of the implementation of them should be examined sufficiently.

- Training of human resources is indispensable for the realization of the Master Plan.
- Acquiring the ability to make plans, establish a vision, and administrate
- Making a training system of human resources and implementation

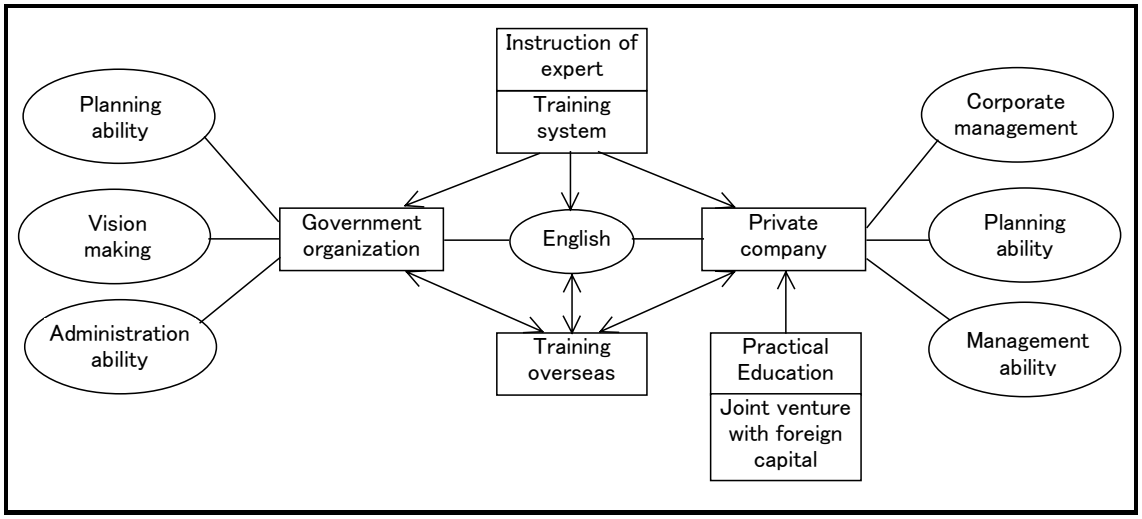

Fig. 5-3-1 Training System

3-2 Private Companies

Training of human resources in private companies is carried out in each company. In case of the introduction of foreign investment by privatization, acquiring knowledge of the free economy and transferring of new technology is possible by joint venture with foreign investment. If a company like Armenian Copper Program (ACP) can receive a loan, US$ 3 million, for company management improvement from the EBRD, it is also useful for training of human resources related to company management under a free economy. If a private company contact with a foreign mining company, financing company, etc. through their business activity, it will be linked to acquire knowledge and know-how. Training like the above through actual practice is important. Human

resource is a resource of the company. Training human resources gives an impact to the company's development. Therefore it is needed to recognize the importance of the training of human resources and implementation of systematic training. It is desirable to carry out the support of training for the promotion of the private sector's activity by implementation of the training of human resources of private companies by the government (Fig. 5-3-1).

4. Mining Industry Policy and Administration

4-1 Mining Industry Policy

Mining industry policy is proposed in this Master Plan. Mining industry policy should be enforced linked to a state development plan. The proposed mining industry policy is a policy for the reconstruction and promotion based on the characteristics of the mining industry of Armenia. Government organizations enforce the policy by evaluation of the policy in the planning stage and examination for realization. A deep understanding of the policy is needed for the people related to the mining industry. Adjustment of the policy should be implemented by the evaluation of the effectiveness through the implementation conditions of the mining industry policy. Moreover, a suitable policy should be realized and carried out. The method of acquiring the view or comment for a private company is indispensable for drafting a suitable policy. The evaluation of policy implementation and changing of the policy should be carried out through a third party organization like the council of mining industry composed of a mining association of private companies, representatives of the private sector and people with much experience and knowledge of the mining industry.

- Mining industry policy linked to the state development plan.
- Understanding of mining industry policy to people related to the mining industry
- Reflection of private companies' view for a suitable mining industry policy

4-2 Administration Abilities

Administration ability for the implementation and management of policy is needed to carry out the mining industry policy. Government organizations of Armenia have high ability in administration. However, the administration ability as a whole organization has been forced into a worsening condition because of the reform of administration, reform of organization, and reduction of manpower of the organizations. Although work such as many kinds of reforms by changing the system and enforcement of the law, etc. in moving to a free economy is increasing; there is a possibility that the administration may not always have a suitable manpower and arrangement of human resources.

Table 5-4-1 Upgrading of the Administration Ability

Items	Improvement Measures for Upgrade
Treatment of administration	Promote IT, networking, uniform documents
Approval and procedure	Simplify (need to give overseas training and inspection, send high ranking government officials)
Draft policy	Hold seminar, train overseas
Make plan	Train overseas, acquire through implementation of Master Plan
Management	Reduction of items of management, uniformity, systemization
Information	Sharing information, disclosing information
Human resources education	Education system, implementation of training seminar

Now the administration is under a period of moving to a free economy on the management of license, procedures for investment, procedures of applying for a license, application for permission for development, etc. Simplification of procedures that require much time is needed for procedures of permission and approval. For improvement of the administration ability

simplification and reduction of management work, upgrading the ability of the bureaucrat are needed to be carried out by Ministry and government (Table 5-4-1).

4-3 State Strategy

Promotion and expansion of the copper business has a high possibility to increase state profits for Armenia. For this matter, a study of the below issues are needed.

- Caucasus area and domestic market of sulfide acid
- Effectiveness of using sulfur for heavy oil for the construction of asphalt roads. Way of acquiring technology for the production method of sulfur.
- Domestic demand of ammonium sulfate and market of the Caucasus area
- Usage of land after neutralization and neutralization by sulfate acid to salt-damaged land
- Confirmation of the amount and grade for the target resources to use for the SX-EW method

Full-scale feasibility study is carried out based on the above study. To position the copper business as a state strategy by making a course for business promotion, cooperation for finance, request to international organization, cooperation to foreign investment, support to domestic company growth, clarification on the state's role to the copper business, etc. should be concreted based on the results of the feasibility study. For Armenia in the reconstruction term of the state, it is sufficiently thought that there is a possibility that only depending on the free market principles is not linked to a business with state profit. The government should realize the copper business over the Ministry level by taking the leadership. Recognition and examination of the advantages and disadvantages for the introduction of foreign investment is needed (Fig. 5-4-1).

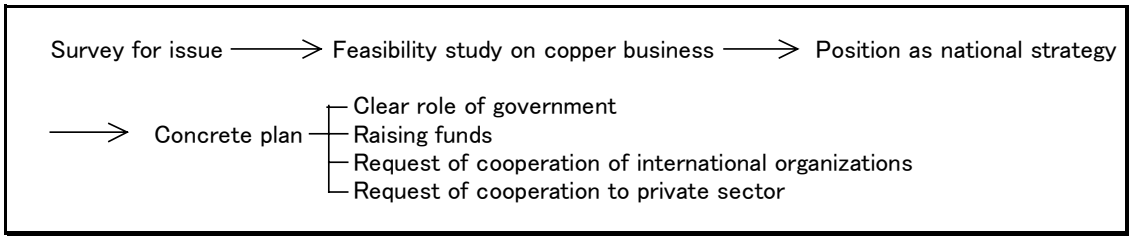

Fig. 5-4-1 Copper Business and National Strategy

5. Issues of Economic Development

5-1 National Finance

Macroeconomy and improvement of national finance are indispensable for the promotion of the mining industry. The Armenia government has actively carried out the reconstruction of the economy after its independence. However, improvement of the macroeconomy indexes and increasing the annual revenue in the national finance must be promoted still now. Conspicuousness of tax payment still has not risen. Tax payment from companies and individuals on their annual income has not increased because of the increase of the tax burden, insufficient management system for collection, and private company's low activity, etc. Moreover, insufficient establishment of a financial market brings difficult conditions on the growth of industry. The increase of debt from international organizations, etc. for the reconstruction of the nation has become a burden to its national finance. Simplification of the tax payment procedure, reduction of the tax rate, establishment of a financial market and raising of industry are needed to advance steadily and strategically (Table 5-5-1).

Table 5-5-1 Comments on Improvement of Finances

Items	Measures for Improvement
Issue of External Bond	Improve parameters of macro-economy.
Issue of National Bonds (Intermediate Term)	Political stability, strength of government trust, reduction of interest rate.
Amount of Stock Trading	Spreading of international accounting standards, transparency of corporate accounting
Establish Intermediate-term Loan by Bank	Strength of bank's trust, improve savings system, reduction of interest rate.
Reduction in Tax Rate	Improvement of tax collection system management, reduction of tax rate of VAT and other taxes
Procedures on Tax Payment	Thorough tax collection at the salary source, simplify application system

5-2 Establishment of International Accounting Standards

The most important matter for companies is "trust". How to obtain trust is directly linked to a company's activity. Accounting is a system to correctly show a third party about the condition of a company. It is a system to secure a company's transparency. It also is a method to measure the company's strength. The company carries out implementation based on strategy as a base of the corporation's "accounting standards", which is used as measurement. Accounting standards are so called a rule of business society.

International accounting standards (IAS) have become a unified standard of the world by progressing of internationalization. The mining industry activity must have activity across boundaries of nations. If this is not so, it is difficult to maintain and develop the mining industry. Trust of the international market for the introduction of foreign investment should be obtained. Government organizations and mining industry companies need to tackle with the same recognition that the establishment and use of IAS have become important for economic development.

5-3 Relations with Neighboring Countries

(1) Copper business with Iran

Now almost all copper concentrate, which is produced in the south area of Armenia, is exported to Iran. The production capacity of Iran's copper smelting plants is 200,000 tons. The domestic supply of copper concentrate in Iran is insufficient. In several years, the copper concentrate of Armenia has an important position for Iran's smelting plants. However, if Iran with its big resources potential becomes active in its exploration and development through promotion by the introduction of foreign investment, it is thought there is a possibility the Armenia copper concentrate exports could become unstable. Therefore in several years, the export of copper concentrate in the south area to Iran is linked to the expansion of the production amount of Armenia's domestic copper concentrate, but in the future the construction of a comprehensive system from the mine to smelter is desirable for the acquisition of maximum profit to Armenia with importance of state profit based on the copper business feasibility study.

Already Iran's companies have participated in Armenia in businesses such as food manufacturing and finance, etc. and expanded their business. A good relation between Armenia and Iran has been established through joint ventures. The relationship in the copper business should be examined sufficiently for its advantages and disadvantages. It is desirable that the business relation can supply each other's weak point or give strength for each weak point. It is

thought to give big effectiveness that exploration and development especially cooperation relation of joint exploration and development for the same resources (porphyry type copper deposit, massive polymetal sulfide deposit) in the adjoining area, metal manufacturing from copper metal and parts business linked to the reduction of the burden to investment and expansion of the market. If the copper manufacturing business operates in an industrial park with special tax incentives by the industrial park method with consideration of the environment, competitiveness is brought by the concentration of production and it becomes the core for the development in the local society. Moreover, it means that Armenia can obtain an export route to the Persian Gulf.

- Joint exploration and development with Iran
- Establishment of industrial park with Iran for copper manufacturing business
- Establishment of export route of the Iran side for Armenia

(2) Relation with Georgia

Before the Alaverdi Smelting Plant was damaged, the Madneuli Mine of Georgia supplied copper concentrate to the Alaverdi Smelting Plant. Now the Madneuli Mine has production of 10,000 tons (metal basis) of copper concentrate. The concentrate has been exported to Europe through a European trader. The transportation cost competitiveness for export has decreased and has given an impact to the sales price of the concentrate. The distance from the Madneuli Mine to Alaverdi is about 70 km. With the progress of the reconstruction of the Alaverdi Smelting Plant, the Madneuli Mine concentrate supply to Alaverdi is for mutual prosperity linked to each countries' profit.

Around the border of Armenia and Georgia is an area of potentiality of a massive polymetal sulfide deposit (copper, zinc, gold). Both countries have accumulated knowledge for exploration and development for this type of deposit. To explore and develop jointly linked to the strength of the relationship of both countries' mining industry and upgrade of the technical level. Moreover, almost all of this type deposit is small-medium scale, target of underground mine and complex ore with a low recovery rate for processing. Therefore if both countries establish a technical development center jointly and carry out technical development jointly, risk dispersion and strengthening of development ability occurs.

- Joint exploration and development for massive sulfide polymetal deposit
- Supply of copper concentrate from the Madneuli Mine of Georgia to the Alaverdi Smelting Plant of Armenia
- Joint technology development with Georgia for the mining and processing areas for polymetal massive sulfide deposits, etc.

(3) Neighboring Countries Relations and Issues

The three Caucasus nations consisting of Armenia, Georgia and Azerbaijan comprise totally a population of 16 million, which enables in size to build up the regional economic bloc. Armenia should take into account the cooperation with those neighboring countries through the economic and business activity. To aim at formation of the Caucasus regional economic bloc with independent from the subordinate Caucasus for the USSR in the era of the FSU, Armenia should build up its economic role to be performed based on its framework and the reciprocal arrangement for making the best use of the resources and industries in each country. A trade fair of Caucasus by JETRO held on 2001 in Japan could be positioned as the first step toward formation of such economic bloc. For realizing the joint economic activity, the joint industrial complex of copper manufacturing business for two countries (Armenia and Iran for example) may be developed to locate in the area adjacent to the border between two countries, and be used as a supply base for materials and commodities to the regional economic bloc. In addition to such scheme, the joint

development of mining and technology by the countries will serve as one of the ways for building up the economic bloc (Table 5-5-2). It will also be needed the mechanism, which the Caucasus regional economic bloc can be linked to the great-sphere economic bloc expanding in the vicinity (Fig. 5-5-1, Fig. 5-5-2). By EU, the scheme of a system for transportation with the support is currently under way to be built up and the preparation and improvement of related infrastructure have already started to be made for these economic blocs.

Table 5-5-2 Field of Mining Industry and Cooperation with the Neighboring Countries

Items	Measures for Improvement
Technology R&D Center	Education and training for human resources, and technology development by using the devices and facilities of the State University of Armenia.
Joint Exploration	Exploration of copper and gold ores in the area adjacent to the border (Georgia and Armenia).
Joint R&D	Joint development of the mine by the companies of two countries.
Smelting & Manufacturing	Allotment of the roles in charge in smelting (Armenia takes charge of copper) and allotment of the roles in the metal processing.
Caucasus Mining Industry Association	The Association plays the role as the traction force in promoting the mining industry in the three countries concerned through collection of the information and its analysis.

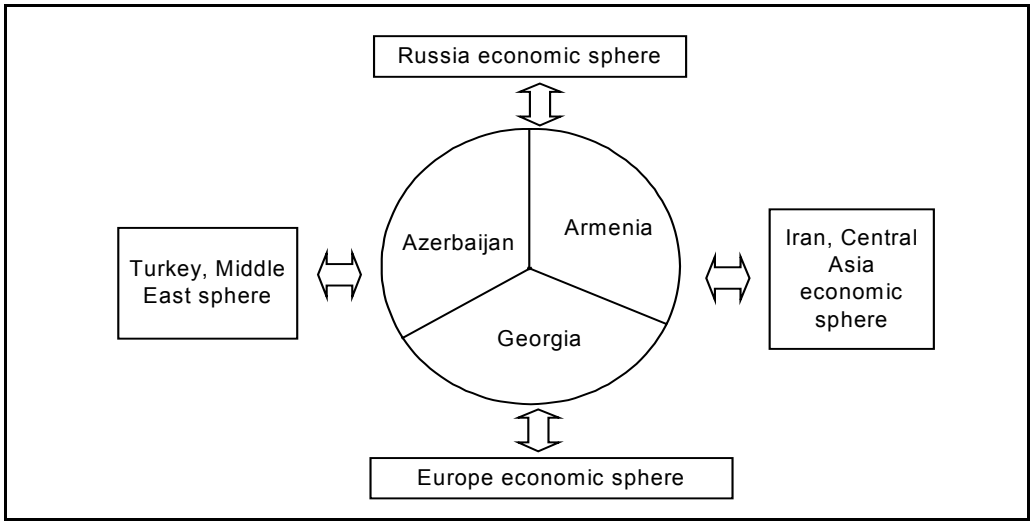

Fig. 5-5-1 Relationship of Caucasus Economic Area with Surrounding Area

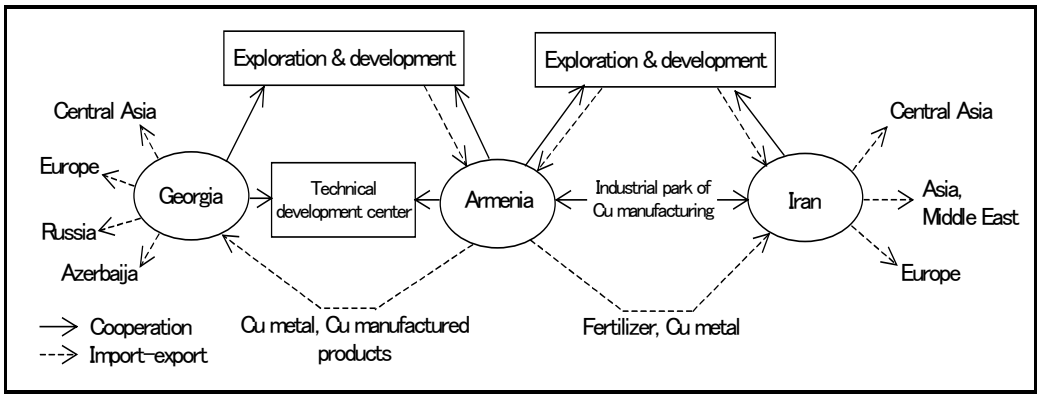

Fig. 5-5-2 Relations with Neighboring Countries and Export Route for Copper Products

6. Recent Situation of Mining Industry

6-1 Globalization

The mining industry in the world has increased the production amount as a whole and has progressed to large-scale production and large-scale equipment and facilities for mines and smelting plants. The oligopoly structure of giant multinational mining industry companies (majors, example, BHP-Billiton, Anglo-American, Rio Tinto) has been established. The top ten producers of copper in the world have a 60% share and gold have a 40% share. Each country's resources have been disclosed. Realistic average price for metal in the previous 35 years has been decreasing (Fig. 5-6-1). Investment country and production basement place of majors have been expanding. Majors have made a competitive strength by the system of large-scale production (Fig. 5-6-2). On the other hand, many mines and smelting plants in a mineral resource country, which lost its competitiveness, are faced with management difficulty. Some of them become targets for merger and acquisition by majors. Most of these countries are small-medium scale mining industry companies. In the world, environmental protection has become important. These companies have been driven to close or withdraw or become difficult to exist by the addition of the environmental costs.

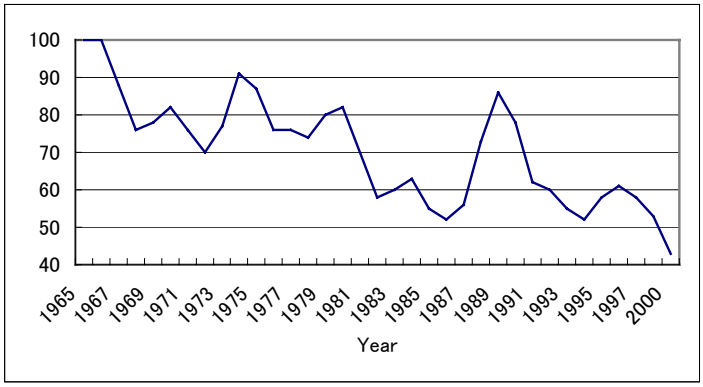

Fig. 5-6-1 Real Trend of Metal Price

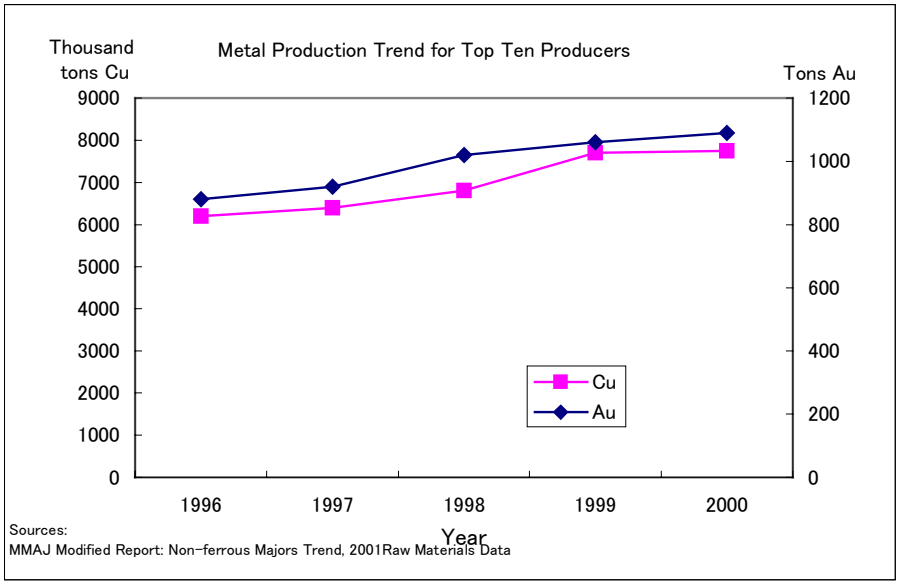

Fig. 5-6-2 Metal Production Trend of Top Ten Producers

This tendency is especially strong in Central Asia, Caucasus and East Europe. Most countries in these areas received big damage of a decreased production amount with the transition to a free economy. There are many mines and smelting plants, which are facing difficult management and closed mines. Each country has promoted privatization and the introduction of foreign investment. However, important decision factors for foreign investors are policy, law, tax system and political stability of each country in addition to attractive mineral resources for participation of foreign investors. These areas' countries, which have not completely escaped out of the former COMECON era's constitution, are in a condition with a big handicap.

Armenia also is faced with the same conditions. Armenia has many disadvantages for the reconstruction and improvement such as 1) improvement with a viewpoint of "competitiveness" for policy, law and tax system compared to other mining industry countries, 2) Simplify the procedure for acquiring a license, 3) Clarify the responsibility of past environmental pollution for the former USSR era, 4) Superannuated mining facilities and equipment, 5) Immature financial markets, 6) Transparency of company and 7) landlocked country. Mining industry policy and promotion measure in the Master Plan are the means for the promotion of the mining industry by overcoming these negative factors. Armenia must recognize these factors in its mining industry by themselves. If there is no strong will and action by the people and organizations related to the mining industry for overcoming these factors to the mining industry trend in the world, the mining industry is not promoted.

6-2 Tax Rate of Mining Countries and Competitiveness to Investment

Factors such as abundant resources, location of mines and deposits, infrastructure (electricity, water, roads, railroads, etc.), procurement, securing manpower, environmental regulations, technical basement, political stability, and simple procedure for acquiring license are important for mining industry companies to invest in the mining sector in a foreign country. In addition to these factors, the tax system and rate are influential decision factors to an investor because it gives an impact directly to the profits. The tax system and rate must be competitive for countries wishing to attract investment. These factors are a big incentive for the investor. The Caucasus and Central Asia area has a disadvantage of high mineral resource tax and social tax rates compared to advanced mining industry countries, South America and Asia, and high main tax rates compared with many countries in the world (Table 5-6-1). The Caucasus and Central Asia area tax burden has high mineral resources tax in addition to social taxes. Each country in Caucasus and Central Asia has a mineral resource tax on revenue. Therefore mineral resource tax is an actual deduction on revenue. This may be one possible cause for making it difficult to make a profit. Now foreign investment to Caucasus and Central Asia area has not progressed according to the expectation of each country. The cause of this is thought to be the economic condition, political stability and financial market, etc. However, it is thought the above tax disadvantage is a big factor. From the viewpoint of tax, Central Asia and Caucasus are not competitive for the introduction of investment.

Armenia is thought that it has relatively competitiveness for investment though it does not have attractive features for investors because of the tax factor from the viewpoints of Europe and USA. Moreover it is needed to have a tax system and rate that is competitive for investment.

Table 5-6-1 Taxes and Company Cost related to Mining Industry

(1) Caucasus and Central Asia

Item	Armenia	Georgia	Kyrgyz	Kazakhstan
Profit tax (on profit)	20%	20%	30%	30%
VAT	20%	20%	20%	20%
Social tax (on salary)	Social security 3% up	27＋4%	33＋1.5%	Pension 25.5% social security 1.5% medical insurance 3% employment fund 2%
Mineral resource tax	royalty 1%	≒sales 3～6%	prod. cost 5～15%	Negotiable
Environment tax	None	None		None
Enterprise activity tax	None	ales-supply cost)×1	None	None
Fund for mineral development	None	None	sales 2～15%	None

(2) South America and Asia

Item	Peru	Chile	Indonesia	Philippines
Profit tax (on profit)	30%	15% plus 35% on distribution	30%	35%
VAT	18%	18%, credits	10%, credits	0～10%
Social tax (on salary)	Housing fund 9% health & accident insurance 3.6% 18 monthly salaries- bonus 1 yr salary- severance profit sharing 8% net profits	Labor accident and occupation fund- 0.9%, 1.7%, 2.6% or 3.4% 1% of payroll for training 2.4% unemployment insurance profit sharing 30%	Old age, disability, death 4% sickness & maternity 6% married, 3% single workman's compensation 0.24-1.74% all based on payroll	Social security 5% up to 12,000 p health insurance 3% workman's compensation 1%
Mineral resource tax	None	Unknown	Au $225/kg <2t $235/kg >2t Cu $45/t <80,000t $55/t >80,000t	sales Cu 2%、Au 4% on gross output value
Environment tax	None	None	None	mine waste: 0.05 p/Mt mine tailings fee: 0.1 p/Mt
Enterprise activity tax	None	None	None	None
Fund for mineral development	None	None	None	None

(3) Western countries

Item	USA (Arizona)	Western Australia	Canada	Sweden
Profit tax (on profit)	15-34% <$10M, 35%>$10M	36%	31.97%	28%
VAT	None	None	7%	25% on equipment
Social tax (on salary)	Workman's compensation+ unemployment insurance (UI) is 6.2% on first $7,000 but UI credit up to 5.4% social security+medicare- 7.65%	Payroll tax 3.95-6% wages < A$600,000 below based on payroll health insurance 3% accident insurance 1.4% old age & disability 2.55% unemployment 3% other social contributions 1.2% with a cap at A$8,000	Federal pension 2.8% of payroll, unemployment insurance 2.95%, State: health, workman's compensation 0.98% to 1.95% of payroll	Social security 33.06% plus 5-10% more in a negotiated agreement
Mineral resource tax	None	Au none Cu ore 7.5% concentrate 5% anode 2.5% realized value	None	None
Environment tax	If alternative minimum taxable income (AMTI) >$2M, tax=0.12%*AMTI	None	None	None
Enterprise activity tax	None	None	None	None
Fund for mineral development	None	None	None	None

6-3 Exploration and Development Target

Securing sources of reserve for the future is indispensable for the promotion of the mining industry and economic growth by the mining industry. It should be developed in the early stage for production by the promotion of exploration to potential areas and deposits in the viewpoint of possible future development of copper deposits.

In the north area, the Tekhut deposit needs to be developed quickly. However, the recovery rate of the drilling core is low (70-75%) in the FSU era. Therefore shallow boring should be carried out to study leaching by using the drilling core. Implementation of a feasibility study is desirable after this work. The Alaverdi plant needs to use silica as flux. To find silica rock with gold around the plant is needed. There is a possibility for feasibility even though the gold grade is low. Therefore exploration with a geochemical survey for silicate rocks with gold around the plant is desirable and needs to be actively promoted.

In the south area, the Dastakerd deposit is in a mine that has been closed since 1974. However the deposit has an average grade (0.95% copper, 0.043% Mo). Therefore it is needed to study the re-development of this deposit, which is a high priority. According to the Ministry of Nature Protection, the structural geology surrounding the Dastakerd deposit is complex. At first, it is important to select an exploration area by the analysis of existing data and do geophysical exploration (IP, electromagnetic exploration by the TDEM method). After this work, it is needed to carry out drilling exploration and drift exploration.

Concerning gold deposits, it is difficult to find a large-scale deposit. Therefore it is desirable to have a target for exploration and development of existing small-medium scale deposits. In the case of a gold deposit (silver), a low sulfide ore, over 10 tons of gold amounts is needed as a general principle. In Armenia, there is no deposit with the possibility of a mine with 10 tons of gold amount with over C_1 reserve, except the Zod and Megradzor deposits, which are under operation. Judgment on development should be done by clarifying the reserve amount and grade by exploration for P and C_2 reserves on other deposits. Therefore exploration should be done with priority for 10 ton gold reserve. Tuhmanuk and Lusajour deposits are listed as target deposits because of having a possible medium-high grade gold (Table 5-6-2).

In the case of polymetal deposits that metals except gold have value, there is the possibility of development even though the gold grade is slightly low. It is thought that the Marjian and Verin Vardanadzor deposits are priority targets of exploration because of the expectation of increasing the reserves, especially Marjian accompanied with Mazmazak mineralization, 3 km northwest of the Marjian deposit. A huge increase of reserves is expected. Also it is recognized the intrusive of quartz monzonite at two places. Mineralization of copper and molybdenum is known. Therefore porphyry copper deposit is expected. Therefore exploration should start at first, regional geological survey, regional geochemical survey; then geophysical survey (IP, TDEM), detailed geological survey, drilling exploration are needed to be implemented.

Table 5-6-2 Recommendation for Exploration

Deposits	District	Mine	Actual condition	Exploration
Copper Deposits	Southern District	Dastakerd	Reserves: 9.6 mill t, 0.95% Cu, 0.043% Mo (Rather high copper grade) Complicated geologic structure Production (underground and open pit): 0.4 mill t, Tailings: 0.09% to 0.16% Cu, 0.008 to 0.0043% Mo	Geophysical survey and drilling
	Northern District	Tekhut	Reserves (B+C1+C2): 450 mill t, 0.35% Cu, 0.022% Mo Drill core recovery in shallow areas: <70% Leached zone: 50 m to 70 m, 0.1% Cu Enriched zone: 20 m±	Drilling for oxidized zone
Gold Deposits	Southern District	Marjian	Reserves (C2): 3.5 mill t, 3.39g/t Au, 1.60% Pb, 1.28% Zn Mazmazak Ore Showing exists in ca 3 km NW More Cu-Mo indices around the mine. It is possible to develop both PC and polymetallic deposits.	Analysis for existing data Geophysical survey and drilling
	Northern District	Alaverdi to Shamloukh	Existence of silicified zones: max 1 g/t Au content in part It is convenient for Cu refinery for flux.	Geochemical survey and drilling

6-4 Small-medium Scale Deposits

Characteristic of resources in Armenia is small-medium scale deposits. The above globalization is selective based on the principle of competitiveness. This gives a big damage to small-medium mining industry companies. The small-medium mining industry companies have kept their role of development as the core of the local economy. However, this matter has given a serious impact to the local society by the company's reduction and closing.

A small-medium scale deposit is not a target of the majors. It is thought that foreign companies participate in the development of medium-scale deposits in Armenia. However, their target is a deposit with the possibility of being mined by open-pit method. Therefore the target deposits are limited. Moreover, it is needed to recognize that foreign companies will withdraw if the feasibility becomes low and there is difficulty making a profit. Although there are some reasons Armenia depends on foreign investors, it is because of the lack of money. It is needed to have a target and realize it to establish a mining industry basement by domestic capital.

The mining industry with a target to participate in the global unified market is forecasted to have difficulty due to sustainable development because of the competitive power of the majors. A comprehensive system from exploration to smelting and manufacturing should be joined in a Caucasus area economic bloc by using Armenia's comprehensive basement. To progress on the development of the small-medium scale deposits linked to the contribution of the economy by underground resources based on a reciprocal relation of the Caucasus three countries and two countries' cooperation in Iran. Development of high-grade ore deposits, management of grade control and systemization are needed for strengthening of competitiveness. For this matter, it should be considered to do technical transfer and technical instruction by experts from mining industry advanced countries and Japan, etc. It is thought to have a two-step loan by the government with a government guarantee and management of a mining fund, etc. for raising funds for

exploration and development for small-medium scale deposits. However, establishing a basement by the government with the possibility of finance from the financial market is a priority matter. It is thought that Armenia's mining industry should have a target, "mining industry activity in the Caucasus economic bloc". The Armenia mining industry activity's target is not a mining industry with globalization.

- Dependence on foreign capital is linked to risk. Raising of the mining industry by domestic capital is important
- Establishment of the financial market and financing from the financial market for developing small-medium deposits
- "Mining activity in the area" in the Caucasus economic bloc

6-5 Importance of Economic Evaluation

Economic evaluation by a pre-feasibility study for resources is indispensable in the stage of exploration and stage of finishing exploration. Moreover, the pre-feasibility study and case study for an operating mine are useful for management improvement. A case study is carried out for the copper mine in this survey. Technical improvement points for mining and processing are proposed. Also concreting problems on management and having a course on improvement became clear. It is needed to promote the mining industry, which can compete in the market economy, by spreading of knowledge on economic evaluation and recognition of its importance. People related to the mining industry especially executives and managers should have skills of economic evaluation.

6-6 Environmental Protection

Mining industry activity causes environmental pollution by the discharge of large amounts of waste in each process such as mining, processing and smelting because it has harmful heavy metals in the deposit. The waste becomes the cause of harmful heavy metal pollution. Waste is linked with health damage to man by the pollution of the soil, underground water and surface water. Also, there is a possibility to bring devastation to the land and destruction to nature by mining. The smoke from smelting plants becomes the cause of acidification of the rivers and acid rain.

Environmental regulations related to the mining industry have become strict in every country. Protection of the environment and local society should be considered from the beginning stage of development. Continuous protection of the environment is required after the completion of the mining activities. Watching the impact to the environment has become strict by monitoring of the mining industry companies by the government, local society and non-governmental organizations (NGOs). Strict management considering the environment has become thorough from the planning stage of the project for the protection against the huge cost in the case of an environmental problem occurs.

The future mining industry activity is difficult without placing a great importance on environmental protection. Environmental pollution has already accumulated in Armenia. The implementation of an environmental survey and countermeasures for the previous pollution must be done. However, countermeasures to environmental problems of the operating mines and smelting plants should be tried immediately to keep the pollution from expanding.

- Sulfur extracting facility of the Alaverdi Smelting Plant
- Clean up of tailings, which exists at the bottom of the river near the Kapan Mine
- Renewal of environmental facilities of operating mines and smelting plants.

Government organizations of the environmental administration must have facilities,

equipment and manpower with a realistic practical function for environmental protection.

6-7 New Mining Industry

Solvent extraction-electrowinning (SX-EW), which produces copper metal directly from copper oxide ore, has increased its production amount for the past 20 years. Now the production share of copper metal by SX-EW is 20% in the world. The production cost is 20% lower than general concentrate production, although the rate is different for each deposit and weather condition. The target is restricted to copper oxide ore. Now technology development is progressing to sulfide ore. Therefore, if the application area expands to sulfide ore such as copper, zinc, etc., there is a possibility that SX-EW will become the mainstream method of the mining industry in the future because of the method's advantages on cost and environmental protection. Tekhut deposit (copper, molybdenum, porphyry deposit), which is possessed by ACP in Armenia, has copper oxide on the top of the deposit. It is desirable to accumulate technology by the introduction of SX-EW method to the Tekhut deposit, even though the SX-EW method has still not been used in Armenia.

In-place leaching method applying the SX-EW method has been thought as a method of direct recovery for only target elements without mining ore in underground. Not only oxide ore, but also sulfide ore becomes a target like the above matter and low-grade ore becomes a possibility of the application. Therefore, the application has no waste rock, tailings and smelting slag, which is discharged in each process of the mining industry. This links the mining industry that is balanced with the environment. If this method is applied to the remaining reserves of closed mines, low-grade ore reserves will be linked to maintaining its resources and useful usage of resources. Moreover, the in-place leaching method is applied to tailings by using the mined-out areas in the mine. This is linked to resolve the environmental problems.

The Santa Cruz deposit of the USA has carried out proving tests of in-place leaching. Also in Japan, Tsuchihata mine is trying this method to process tailings by filling the mined-out areas on a small scale. However, there are many issues for technology development, such as making an environment for the leaching solution to leach useful elements by freely moving in an underground deposit, making many cracks to increase the contact area of the mineral containing the metal to the leaching solution, and making a closed environment to prevent the underground water outside of the deposit from mixing with the leaching solution. This 21st century new mining industry has a possibility for realization. Armenia also needs to watch the trend of technical development of the new mining industry like the above new mining industry (Fig. 5-6-3, Fig 5-6-4).

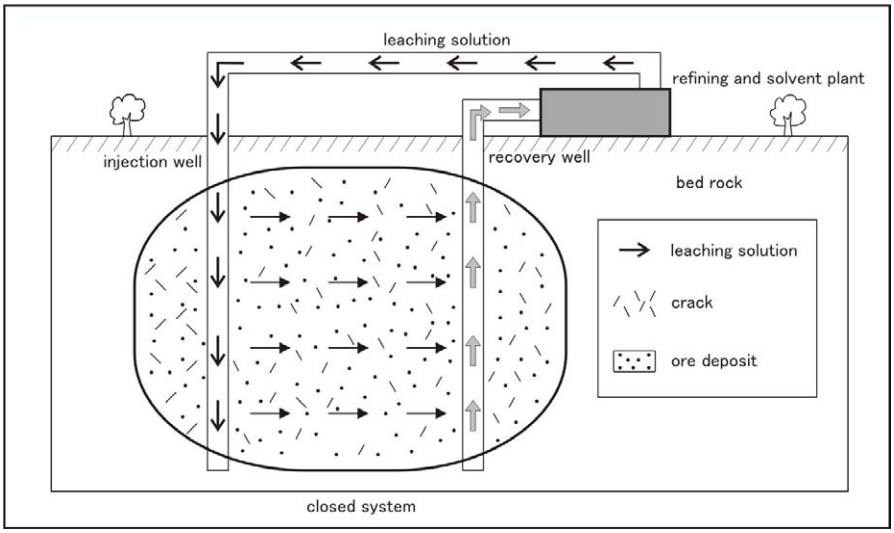

Fig. 5-6-3 Schematic Diagram of In-place Leaching

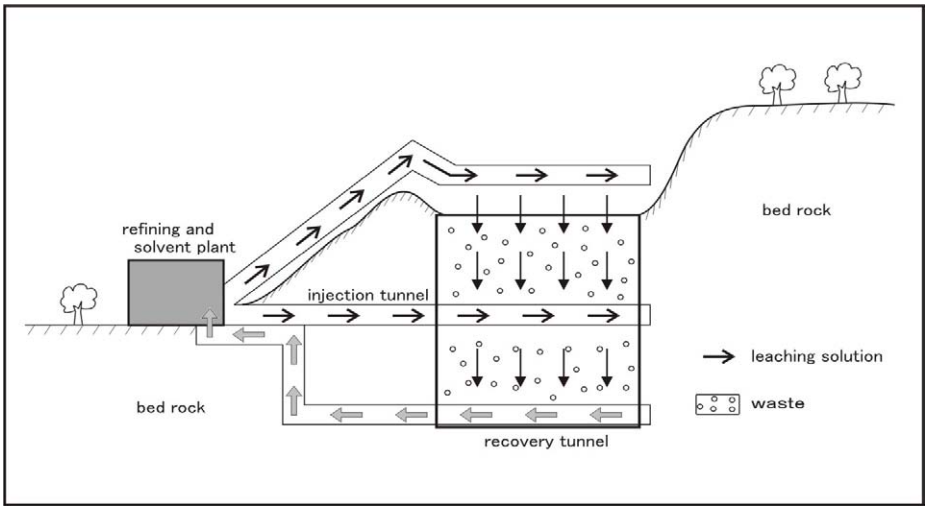

Fig. 5-6-4 Schematic Diagram of In-place Leaching used for a Mined-out Space

7. From Promotion of Mining Industry to Sustainable Development

7-1 Sustainable Development

"Sustainable Development" is the consensus of the international society. In the mining field, the Mining, Mineral and Sustainable Development (MMSD) project through the World Business Council for Sustainable Development (WBCSD) and International Institute for Environment and Development (IIED) has surveyed and studied for two years and their report was issued in May 2002. The MMSD report covered mineral, metal, exploration, production, usage, re-usage, re-cycling and final destruction. This report provides an efficient framework to the mining industry field for sustainable development including these broad fields.

- Comprehensive economic activity accompanied with efficient government system, social problems, and environmental protection ⇨ "sustainable development"
- Make cost reduction, make fair distribution of profit and, make stable condition for present generation, and make confirmation on the possibility of development for the next generation. ⇨ establish short- and long-term targets.
- Respect for rights and interest.

- Understanding of challenge and restriction.
- Public organization for thorough conformity to suitable standards.
- Scale with proven possibility for improvement and evaluation of progress.

These are basic concepts and each item is inter-related. Improvement by checking progress with the plan and long-term targets is the base. It is needed to advance development with understanding of standards and restrictions (Fig. 5-7-1).

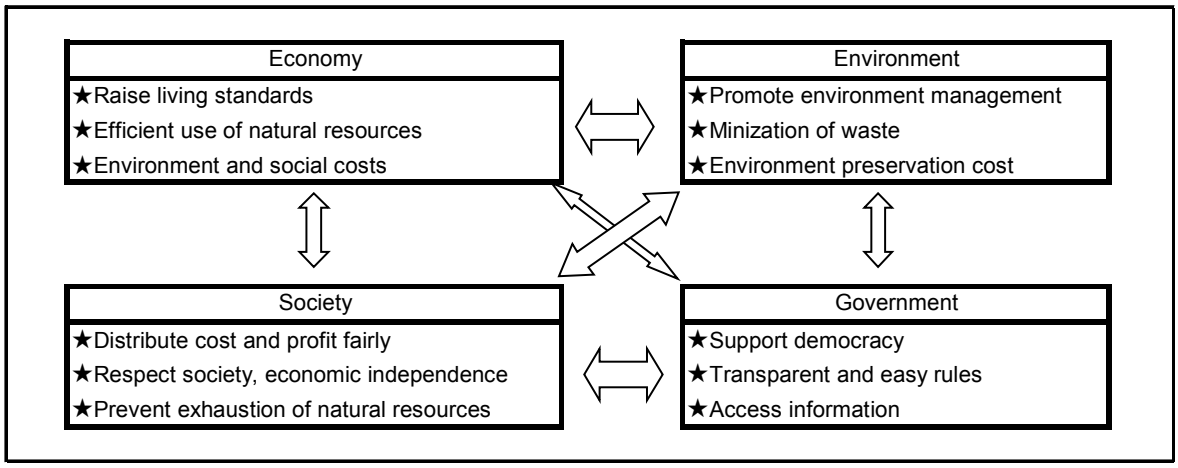

Figure 5-7-1 Basic Concept of Sustainable Development

There are many subjects in the mining industry field for realizing "sustainable development" with these basic concepts. The main subjects are the role of resource development, tackling the environment subject, relation with the local society, value for information, etc. To tackle these subjects link to the promotion of the mining industry and development (Fig. 5-7-2).

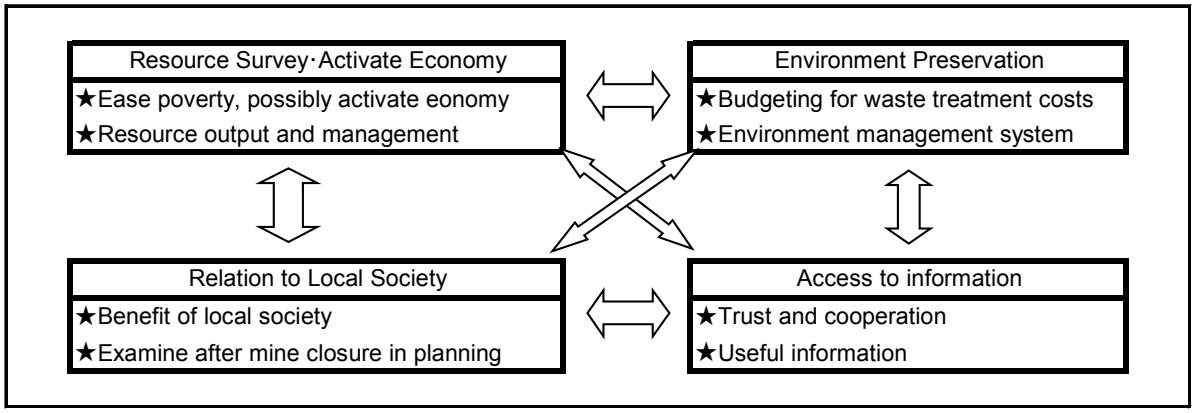

Fig. 5-7-2 Principal Subjects for Sustainable Development

There are important subjects, which should reform the present condition for "sustainable development". The impact will be given for tackling the above mentioned main subjects if these reforms are not carried out.

- Who is to pay for the loss of heritage regarding to problems such as pollution and site destruction? How will money be raised?
- If the basic recognition for the mineral resource potential contribution to the national economy is lacking, the mining industry activity is not linked to fair usage and easing poverty.
- Group correspondence like the creation of good results by companies of all sizes is needed.

It is needed to live in mutual peace and prosperity.

- Organizations like the Mining Association can provide group correspondence to local society and government organizations.

MMSD drew up four steps for realization of sustainable development, namely these steps are to construct an understanding of sustainable development, to make a management system, to establish a corporation relationship in relation to the advantages and disadvantages and to establish the ability of treatment for effective activity (Table 5-7-1). Armenia mining industry must attempt to promote reconstruction of mines and promotion of exploration and development in the near future. However in realization of this Master Plan, the Armenia government should study the MMSD report for sustainable development and should tackle to use the framework of sustainable development.

Table 5-7-1 Outline of Sustainable Promotion Method (MMSD)

Step	Subject	Contents
1	Understanding of sustainable development	Enter curriculum for mine engineer education.
		Understand related to government organization, mine manager
		Engineer, researcher understand relation between their activity and this problem.
2	Make rule at organization level and management system	Make rule for sustainable development for each organization
		Company makes a management system for this subject (It I linked to low cost and efficiency)
3	Cooperation on advantage and disadvantage of mutual relation	Build a network of the group, organization
		Communication based on individual, make adjustment
4	Construction of management ability for efficient activity	Make relations with local society from survey stage
		Implement survey of environment and society from start of project
		Make contribution plan for local society around mine
		Review law, improve transparency of information disclosure by government

7-2 Correspondence to Globalization

Globalization requires severe competition with international liberalization and decreasing metal prices in the mining field. Many countries have opened their market in the mining industry field and they have attempted the introduction of foreign capital. Multinational companies (majors), have accelerated large-scale production and scaling up of machines, equipment, etc. by investment to develop large-scale deposits and large-scale mines. Super large-scale mines producing over 500,000 tons per year of copper metal basis are in operation in Chile and Indonesia. Solvent extraction electrowinning (SX-EX method), which produces metal directly from ore, has a 20% share of copper metal production in the world. The production cost is 20% lower compared to the usual method, which produces concentrate from ore and copper from smelting concentrate. It has become highly competitive with its low cost. Large capacity equipment, machines, etc., and large-scale production need huge amounts of investment. Therefore the competitiveness of small-medium scale mining companies, which have little capital, will drop more. The majors' production ratio has an increasing tendency.

Like this trend of the mining industry by globalization, the Armenia government should study how to correspond to this trend. It is an important subject that Armenia knows how to survive, which has not high potential for a large-scale deposit to exist because of having mostly small-medium mines and deposits. The Armenia government emphasizes dependence on foreign investment. However, it is needed to recognize that foreign capital can withdraw if their

profitability becomes low and they have unprofitability. It should be realized its mining industry with a target for the construction of a mining industry basement by raising domestic capital and by domestic capital. Needless to say, emphasizing competitiveness by the smelting business in an area of cheap freight, reciprocal relationships among the three countries in the Caucasus, quality control, development of high-grade deposit and systemization, etc. should be needed. Moreover, it should be thought to seek mining activity in an area by the construction of a Caucasus economic block.

8. Information Disclosure and Use of Web Site

The fund and subsidy for the mining industry promotion should be used with a limited term and limited usage, which was mentioned in this Master Plan already. It is indispensable to secure transparency for having an efficient functional subsidy. It is needed to make a consensus of the nation about the understanding the administration of the subsidy, its procedure and limit to a target by information disclosure. Mineral resource use tax is thought to be one of the sources for the mining fund. However there is a possibility that the reduction of tax revenue by incentive privilege of the tax system could produce fear to accelerate more reductions of tax revenue. Development of industries including the mining industry and protection of the environment should be in harmony. Presently the development of industry is positioned with the importance of the environment in the trend of the great importance placed on environmental protection in the whole world. Therefore it is needed to study that the source of the fund for the mining fund is from the environment tax, but it is important for securing transparency for this fund. Establishing of a fund is difficult without making a consensus of the nation.

Disclosure is a principle for the realization of subsidy and fund. It is desirable to use the web site, which was constructed by this survey as a place for information disclosure. Now the web site has been made in English. However, it is important and useful as a place for making a consensus of the nation by making the site in the Armenian language.

(End of the report)